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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE SURGERY OF THE DOUBLE KIDNEY

REPORT OF A CASE OF RESECTION OF UPPER SEGMENT FOR CALCULOUS PYONEPHROSIS

BY HUGH H. YOUNG, M.D., F.A.C.S. AND EDWIN G. DAVIS, M.D., BALTIMORE

From the Johns Hopkins Hospital, Baltimore, Md.

**D**URING recent years we have had in our clinic several cases of double kidney and ureter in which one portion of the double kidney was diseased. Only one of these cases has come to operation and a careful study of the literature shows that although the condition is not very rare its recognition and cure by operation is extremely rare. In fact we can find no satisfactory report of any such case and on this account it seems quite timely to report in full the following case in which a large branched calculus occupying the upper half of a double kidney was recognized and the condition cured by resection of the upper diseased half of the kidney with its special pelvis and ureter. Through the kindness of Dr. Franklin P. Mall who placed at our disposal the complete series of embryos of the Carnegie Embryological Institute and the assistance of Dr. George L. Streeter we have been able to study the early embryology of the ureter and to make drawings and microphotographs which illustrate the development of this frequent and interesting anomaly.

**History.** The patient a man of 55 was admitted on April 7, 1916 to the James Buchanan Brady Urological Institute complaining of a pain in the left flank. The pain was dull and aching in character, was increased by exertion and had been present with exacerbations and remissions for ten years. There was no history of any attack resembling

renal colic. He complained also of frequency of urination voiding about every two hours by day and night. Pain in the back together with frequency and some burning on urination were his only symptoms. The patient could not name the exact date of onset but stated that symptoms had been present for at least ten years during a great part of which time he had been unable to work. His family history and past history were unimportant.

**Examination.** The general physical examination was practically negative. The patient was a well-nourished middle-aged man. With the exception of a few fine crackling rales audible on deep inspiration over the posterior base of each lung no abnormality of the chest or abdomen was made out. Neither kidney could be felt nor was there any tenderness in either kidney region. The urine showed a trace of albumin and a heavy sediment which in the stained specimen was seen to be made up of pus with numerous bacilli.

**X-ray.** Neither renal shadow was to be made out but in the region of the upper pole of the left kidney was seen a large irregularly branching calculus as shown in Figure 1. No shadow was seen in the region of the right kidney or of either ureter.

**Cystoscopy and ureteral catheterization.** There was no residual urine and the bladder capacity was normal. The cystoscope which was easily inserted showed a bladder mucosa somewhat reddened and inflamed throughout and an elevated and thickened trigone. There was no stone or diverticulum. The ureteral catheters which met with no obstruction were passed up each ureter a distance of 15 centimeters. The urine obtained from the right catheter was macroscopically clear and the centrifuged specimen showed only a few red blood cells while that from the left was purulent. Phenolsulphone



Fig. 1. Kidney with large, dark, irregular mass attached to its surface.



Fig. 2. Kidney with large, dark, irregular mass attached to its surface.

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k. i. d. n. y. t. l. b. u. l. d. i. l. d. u. p. p. l. a. d.  
r. t. l. l. c. n. l. e. d. t. l. a. t. g. i. a. d.  
d. l. The. p. a. t. i. t. o. l. t. h. o. p. to. l. l.  
P. H. l. e. y. l. a. t. i. n. t. l. p. e. m. r. m. i.  
h. t. h. i. t. u. t. l. f. a. n. e. t. m. l. l. e. d. c.  
t. l. l. u. t. u. r. o. p. a. l. e. c. t. n. f. w. h. c. h.  
h. l. a. o. m. p. l. e. t. a. b. e. f. k. d. n. v. t. b. u. l.  
A. l. m. t. e. n. t. l. y. h. i. l. i. n. g. the. s. v. c. w. a. a. l. a. g. e. b. r. a. n. c. h. g.  
c. l. l. h. o. n. F. i. g. u. r. e. 6.



FIG. 3. First stage of operation showing the double kidney exposed. The upper large pyonephrotic portion is demarcated from the lower normal portion by a furrow. The point of bifurcation of the ureter is diagrammatically indicated by dotted line.

**Postoperative history.** The immediate convalescence was uneventful. On the twelfth day the last drain was removed leaving a small narrow sinus which persisted with a scant mucoid discharge until the thirty-fourth day when a urinary fistula developed. On the following day the patient's temperature rose to 103 and remained irregularly elevated for three days then returning to normal and remaining so the urinary drainage ceasing on the day after the temperature dropped. Two weeks later the patient was discharged from the hospital with the incision entirely healed and the temperature normal. Urine examination at this time showed still a trace of albumin and only a very few pus cells. A thorium pyelogram made on the day of discharge showed on the left side a pelvis slightly smaller than normal and with normal calices just as before operation (Fig. 7). The stump of the excised ureter was not visible. The phenolsulphonphthalein test showed a secretion of 3 per cent from the left side in half an hour and 15 per cent from the right. The urine from the right side was clear while that from the left still showed a few pus cells and bacilli.

On August 10 four months after operation the patient returned for examination. His general condition was excellent he was entirely relieved



FIG. 4. Second stage of operation. The two segments of kidney tissue have been separated by a transverse incision just above the level of the furrow.

from symptoms and able to resume his work. Ureteral catheterization done at this time showed a clear uninfected urine from each kidney. The phenolsulphonphthalein output after thirty minutes was 20 per cent from the right side and 5 per cent from the left.

#### FREQUENCY AND SURGICAL IMPORTANCE OF RENAL ANOMALY

Anomalies of the kidney and ureter occur more frequently than is generally appreciated and among such kidneys a relatively large number show pathological changes. In other words malformation predisposes to disease. Botez ( ) demonstrated this by a statistical study. Basing his calculation upon 51,504 autopsy records he found the frequency of horseshoe kidney to be 1 in 715 while in a series of 1000 kidney operations the proportion was 1 in 143, a percentage five times as great. From this he concluded that a horse



l k C l l ft m l f m ppe h l f  
d bl kd

F Th d t k f p t The l se d g  
m t h bc m l t i l k i j d h m  
h g f m m l p o t t l l d b y m t t

shoe kidney is more apt to become diseased  
than a normal kidney Robin on (3) among



Fg Th m py l gr m m d ft m l f  
ppe lc l py pl t p t f d bl kd y  
t t th F

fifty collected specimens of duplicate ureter found that hydroneurter (of one ureter) occurred in 24 per cent. In a series of 24 cases of explored double kidney and ureter to be cited below the pathological process was located in the upper kidney segment in 19 instances. Judging from this uneven percentage it is fair to assume that partial obstruction of the superior ureter due to its position with respect to the lower kidney segment and to the kidney pedicle had been an important factor in producing disease. Girard (4) among 44 cases of ectopic kidney found 1 hydronephroses. An idea as to the frequency of renal anomaly may be obtained from the studies of Naumann (5) who found 100 anomalous kidneys in a series of 1017 autopsies about 1 per cent. This series included only gross renal anomaly such as fused ectopic cystic atrophic and lobulated kidney. Anomalies of the renal vessels are very much more frequent. Papin (6) in examining a series of 324 kidneys found 64 (exactly 20 per cent) in which there were at least two renal arteries. If 20 per cent of all kidneys possess anomalous arteries the percentage of individual with anomalous renal arteries must necessarily be still higher. For a splendid review of the entire subject



Fig. 8

Fig. 8. Clacae of a 3 millimeter human embryo. The wolffian ducts have not yet developed in this region. *AD* Allantoic duct, *I* intestine, *Cl* cloaca. (After model by Heibel.)



Fig. 6

11 9 Cloaca of a 4 millimeter human embryo. The Wolffian duct has appeared and enters the cloaca on either side. 11 D. Wolffian duct. 1 into line C1 cloaca. 11 D. Wolffian duct. (After model by Keibel.)

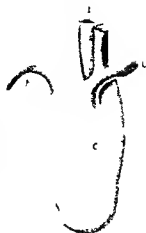
F<sub>1</sub> 10

FIG. 6. From a 65 millimeter human embryo. The ureteral bud (seen springing from the Wolffian duct close to its opening into the cloaca). The separation of the cloaca into intestinal and uroanal portions by the urorectal septum has begun. For the sake of clearance, the right Wolffian duct has been omitted in the drawing and in the following. A D. Wolffian duct; I, intestine; Cl, cloaca; W, Wolffian duct; U B, ureteral bud. (After model by Heibel.)

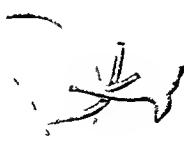
dealing with the importance and the frequency of the various form of renal and ureteral malformation and including an

extensive bibliography the reader is referred to the complete work of Adrain and Lichtenberg (7)



For

FIG. 11. From millimeter human embryo. The urorectal epitum has clefted the cloaca into two distinct portions, the Wolffian duct opening into the anterior portion. The lower end of the Wolffian duct has become dilated. *CM*, Cloacal membrane; *Cl*, cloaca; *I*, intestine; *B*, Wolffian duct; *U*, ureteral bud; *URS*, urorectal epitum. (After model by Iehl.)



F1 12

The urorectal septum has almost reached the cloacal membrane. The tip of the urorectal bud has become bulbous and has a distinct tendency to bifurcate. The Wolffian duct & the ureter have acquired separate openings into the bladder side by side. *C M C cul m mb ne B bladder U R S urorectal septum R*

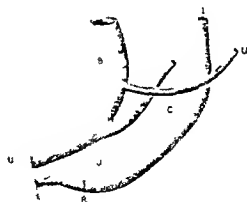


Fig. 13

rectum I intestine II D wolffian duct L ureter  
P P primate c pel (After model by Keibel)

Fig. 13. From a 3 millimeter human embryo. The urorectal septum has reached the cloacal membrane completely dividing the cloaca into bladder and rectum. The dotted line indicates the limit to which the coelom descends into the two layers of the peritoneal pouch later becoming fused to form Denavillers' 2 o-layered sac. The ureter and the Wolffian duct have acquired separate orifices and the latter has shifted dorsward and later become the ejaculatory duct. *U M* Uroental membrane. *A M* anal membrane. *B* bladder. *R* rectum. *D* Wolffian duct. *U R S* urorectal septum. *C* coelom. *I* intestine. *L* ureter. (After model by Keibel.)



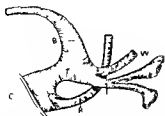


Fig. 4. Schematic diagram of a kidney with a duplicated ureter. The diagram shows a kidney with two ureters branching from it. Labels include 'c' for calyx, 'f' for fimbria, 't' for tubule, 'b' for body, 'l' for loop, 'd' for duct, 'm' for mesonephros, 'p' for pronephros, 'n' for nephros, 'g' for gonad, 'h' for heart, 'l' for liver, 's' for stomach, 'i' for intestine, 'p' for pancreas, 'b' for bladder, 'v' for vagina, 'u' for uterus, 'o' for ovary, 'm' for mesonephros, 'p' for pronephros, 'n' for nephros, 'g' for gonad, 'h' for heart, 'l' for liver, 's' for stomach, 'i' for intestine, 'p' for pancreas, 'b' for bladder, 'v' for vagina, 'u' for uterus, 'o' for ovary.

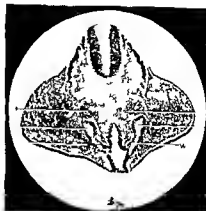


Fig. 5. Schematic diagram of a kidney with a duplicated ureter. The diagram shows a kidney with two ureters branching from it. Labels include 'c' for calyx, 'f' for fimbria, 't' for tubule, 'b' for body, 'l' for loop, 'd' for duct, 'm' for mesonephros, 'p' for pronephros, 'n' for nephros, 'g' for gonad, 'h' for heart, 'l' for liver, 's' for stomach, 'i' for intestine, 'p' for pancreas, 'b' for bladder, 'v' for vagina, 'u' for uterus, 'o' for ovary, 'm' for mesonephros, 'p' for pronephros, 'n' for nephros, 'g' for gonad, 'h' for heart, 'l' for liver, 's' for stomach, 'i' for intestine, 'p' for pancreas, 'b' for bladder, 'v' for vagina, 'u' for uterus, 'o' for ovary.

Ureteral duplication with double pelvis and kidney is surprisingly common. It occurs more frequently than all the other forms of gross renal anomaly taken together. Poirer (8), Wagner (9) and Bostroem (10) independently concluded that 3 per cent of all individuals have double or biphid ureter while Robinson found six instances in one hundred consecutive autopsies. As early as 1878 Weigert (11) had noted the frequency of this anomaly and stated that more than one case occurred in every hundred. Four cases of double ureter out of 165 dissections were reported by Kerr (12). In examining 60 human embryos Iohlmann (13) found two instances of double ureter; the embryos being 13 and 24 millimeters in length respectively. The condition therefore is one which every urologist is certain to encounter and which should be diagnosed before operation either by cysto copy or pycelography in many of the cases.

#### EMBRYOLOGICAL DEVELOPMENT

In considering the formation of double ureter it is of interest to review briefly the facts known about the early development of the ureter and kidney from the wolffian duct. It will be remembered that during the embryological development of the higher vertebrates three successive types of excretory organ (pronephros, mesonephros and metanephros) are formed in the order named, the first two being provisional or temporary and the third becoming the permanent kidney. All three are of mesodermal origin being derived from the nephrotomes or primitive segment stalks, a series of mesodermal cell

masses extending longitudinally on either side of the neural canal and lying between the primitive segments and the lateral mesodermal plates. Considered as a whole these primitive segment stalks make up the nephrogenic cord, the parent structure of all three excretory organs. After the formation of the pronephros, which early takes place from its cranial portion, the nephrogenic cord becomes divided into metanephrogenic and metanephrogenic portions, the former giving rise to the wolffian body and the latter the caudal portion being destined to form the excreting portion of the permanent kidney.

The pronephros in some of the lower vertebrates is well developed and the permanent and only excretory organ while in mammal it is quite rudimentary and may be demonstrated for only a very short period during the life of the embryo. Although its presence in the human embryo is very transient it has been definitely shown that it exists (Felix, 14) that it occurs only in the region of the first twelve primitive segments, that its development begins before the embryo has reached the 2 millimeter stage and that it has undergone complete atrophy (except for its duct, the primary excretory duct) by the time that the embryo has reached a



Fig 16

Fig 16 Sagittal section through a 5 millimeter human embryo showing in an almost diagrammatic manner the Wolffian duct with its ureteral bud terminating in a bulbous swelling the primitive pelvis. Surrounding the latter is a zone of metanephrogenic tissue clearly differentiated from the surrounding mesoderm. *M* Mesonephrogenic cell *P* Primitive pelvis *D* Wolffian duct *L* Ureter *C* Cecum (Fml ryo Mall 1354 slide 3 row 3 sec 2)

Fig 17 Sagittal section through a 6 millimeter human embryo showing another almost diagrammatic picture of the ureteral bud. This section is the one from which Figure 16 was taken if unfortunately happened to be in exactly the right plane to cut both Wolffian duct



Fig 17



Fig 18

and ureter longitudinally. *D* Wolffian duct *C* Cecum *M* Mesonephrogenic cell *P* Primitive pelvis *L* Ureter (Embryo Mall 31 slide 3 row 3 sec 5)

Fig 18 Cross section through cloaca of a 6 millimeter human embryo. One Wolffian duct shows a ureteral bud very early in the progress of evagination. Note that although the distance which the ureteral tip has grown is less than the diameter of the Wolffian duct the former is already surmounted by the cap of metanephrogenic cells. *M* Mesonephrogenic cell *L* B Ureteral bud *D* Wolffian duct *P* C Primitive pelvis *C* Cecum *O* Omphaloenteric pleura (Lml ryo Mall 800 slide 22 row 3 sec 3)

length of 3 millimeters. It has no function and is of importance only in that its duct persists to form the Wolffian duct the excretory duct of the mesonephros.

The mesonephros or Wolffian body arising

from the primitive segment stalks from the fifth cervical to the third lumbar segments (the mid portion of the nephrogenic cord) and consisting of a series of glomeruli and tubules opening into a common efferent duct is the



Fig 19



Fig 20

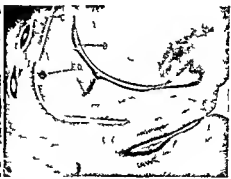


Fig 21

Fig 19 Higher magnification of ureteral bud shown in Figure 18. Note the sharpness of the stain of the metanephrogenic cell in contrast with those of the surrounding mesoderm. *M* Mesonephrogenic cell *L* B Ureteral bud *D* Wolffian duct

Fig 20 Sagittal section through a 6 millimeter human embryo showing distinct bifurcation of primitive pelvis. This bifurcation may be shown to take place as early as the 8 millimeter stage although it happened that none of the 8 millimeter embryos studied were situated in the correct plane to demonstrate the bifurcation in a clearly cut diagrammatic picture as the above section

from a 6 millimeter embryo supplied. *L* Ureter *P* Primitive pelvis *M* Mesonephrogenic cell *A* Aorta (Embryo Mall 1197 slide 1 row 1 sec 5)

Fig 21 Sagittal section through the cloaca of a 3 millimeter human embryo showing the cloaca completely separated into urogenital and rectal portions by the urogenital septum. A pouch of peritoneum (*C*) is seen extending well down beyond the point of entrance of the ejaculatory duct (Wolffian duct) into the future urethra. It is these layers of peritoneum that later fuse to form *D* nonvulvular fascia *I* Intestine *C* Cecum *E* D Ejaculatory duct *B* bladder *R* rectum *L* Ureter (Embryo Mall 43 slide 4 row 1 sec 3)



l g B l t l l c l u l b h l  
 l f l h g p l d c l f s h t k d f l t h  
 p e l d l f t h p p e p o t f t h l f t k d y  
 h h d u b l T h l p t l f t h d l l d  
 m l y p l t l l b b d d  
 t h h t k d e y b t t h l t b c t l p l t  
 p l a d t l (C H H X g)

permanent excretory organ in certain fishes and amphibians but undergoes atrophy in man. Its duct, the mesonephric or Wolffian duct, opens into the cloaca (the blind caudal extremity of the intestinal tract) which it reaches at about the 4 or 4.5 millimeter stage of embryonic life, as shown in Figures 8 and 9. Felix considers that in man the mesonephros does not function as an excretory organ because it is well on its way toward degeneration before the metanephros or permanent kidney has sufficiently developed to assume any excretory function that the former might have had. The mesonephros, at the height of its development during the fourth and fifth weeks of embryonic life (Kelly and Burnham 15) and undergoes atrophy from the eighth to the sixteenth weeks, the duct persisting as the vas deferens in the male and

being rudimentary in the form of Gaertner's duct in the female.

The anlage of the metanephros or permanent kidney appears (in an embryo of about 5 millimeters) as a budding or evagination from the lower end of the Wolffian duct close to its opening into the cloaca, as shown in Figures 10, 15, 16, and 17. The stage of renal development, however, corresponds only approximately to the external measurements of the embryo and therefore embryos larger than 5 millimeters may show no evidence of ureteral bud. Such was the case in embryos 1075 and 875 of the Mall collection, each of which measured 6 millimeters. This bud is destined to form the ureter, pelvis, calyces, and collecting tubules, that is, the entire efferent apparatus, while the secreting portion of the kidney, including Bowman's capsules, convoluted tubules, and ascending and descending loop of Henle, is derived from a mass of mesodermal cells forming the so-called metanephrogenic tissue, which, as stated above, has its origin from the caudal portion of the nephrogenic cord. This mass of cells surrounds the tip of the ureter very soon after its evagination, even before the bud has grown a distance equivalent to the diameter of the Wolffian duct, and is shown in Figures 18 and 19, the nuclei staining very deeply in sharp contrast with the surrounding mesoderm. These specialized mesodermal cells are also shown in Figures 16 and 17 and are seen to form a distinct, almost diagrammatic, mesodermal cap covering the bulbous tip of the ureteral bud. The ureteral bud grows at first dorsally toward the vertebral column and then turns and grows cranially, the tip being surmounted or capped by the mass of metanephrogenic cells which accompanies it in its ascent. As early as the 6.6 millimeter stage the ureteral tip has become bulbous, the primitive pelvis thus being differentiated from the more slender stalk, the future ureter (Fig. 1 and 2). A continued process of outgrowth and branching produces the complete system of calyces and collecting tubules. During the ascent of the kidney, changes are taking place in the region of the lower end of the ureter. By a gradual downgrowth of the urorectal

septum which first appears as a saddle like depression between the allantois and in testine the cloaca becomes divided into urogenital and intestinal portions the future bladder and rectum. The series of cloacal models shown in Figures 8 9 10 11 12 and 13 indicates the various stages by which the cloaca becomes divided into separate portions by this coronal septum which finally reaches the cloacal membrane dividing the latter into urogenital and anal membranes. The septum passes posterior to the orifices of the wolffian ducts so that the latter come to open into the urogenital portion. Figure 1 which is a sagittal section passing through the bladder and rectum of a 23 millimeter embryo shows that a pouch of peritoneum (C) extends down into the urorectal septum to a point well beyond the entrance of the wolffian ducts (ejaculatory ducts) into the urethra. This peritoneal pouch subsequently becomes obliterated and its identical position comes to be occupied by Denonvilliers two layered fascia which in adult life intervenes between prostate and rectum and is of such great surgical importance both as a cleavage plane in perineal prostatic and seminal vesicle operations and as a barrier in limiting the extent of malignant disease of the prostate. As early as 1837 Denonvilliers (45) wrote an excellent anatomical description of this fascia although he did not understand its embryological significance and evidently did not recognize the existence of more than one layer. By a process of dilatation as shown in Figures 11 and 12 the lower end of the wolffian duct comes to form a portion of the wall of the future bladder the ureter thus acquiring an orifice separate and distinct from that of the wolffian duct which shifts downward and later becomes the ejaculatory duct (Fig 13).

We have stated above that at about the 8 millimeter stage the blind bulbous tip of the ureter (the primitive pelvis) normally splits into upper and lower divisions the first evidence of the calyces (Figs 12 and 10). There is a general agreement among authors that the formation of incomplete double ureter may be accounted for by a premature or exaggerated bifurcation of the tip of the

ureteral bud the split extending varying distances down the ureteral stalk instead of being confined to the bulbous tip or primitive pelvis (Fig 14). Felix describes this as a 'precocious splitting of the ureter the bifurcation taking place before the formation of the primitive renal pelvis and the two ureters thus formed ascending parallel to one another. He designates such forms of ureter as cleft ureter reserving the term "double ureter" only for those that have separate openings in the bladder. We have seen no case of partial ureteral duplication in which the portion of the ureter nearest the kidney was single and that nearest the bladder double nor have we found records of any such case either in the pathological or the surgical literature. It would be difficult to explain such a condition embryologically.

Concerning the origin of complete double ureter there is some difference of opinion. Felix considers that such ureters must necessarily arise as separate outbuddings from the wolffian duct. According to Pohlman the bifurcation may take place so close to the wolffian duct that the two ureters acquire separate orifices through the process of dilatation of the caudal end of the wolffian duct by which process the latter becomes a part of the bladder wall. Huntington (16) cites a case of bifid ureter with one perfectly formed pelvis and primary and secondary calyces and the other pelvis incomplete. He considers that since this normal pelvis could have arisen only as the result of a normal development of a normal ureteral bud the second ureter and pelvis must therefore have arisen as a lateral sprout from the main ureteral stem. It may be stated as a general rule that in case of complete double ureter the ureter which has its orifice lowest in the bladder drains the higher renal pelvis as was pointed out by Weigert as early as 1877. In cases of resection of a portion of the double kidney this crossing of the ureter would be of surgical importance.

#### ANALYSIS OF CASES IN LITERATURE

Excluding the numerous reported cases of bifid or double ureter demonstrated by autopsy or dissection and those demonstrated

by cystoscopy and by examination of the external genitalia we have been able to find in the literature in addition to the case we are reporting at present twenty nine instances in which this form of anomalous kidney was operated upon. We have been able to find only the briefest reference to two of these (cases of Lisendrath and Israel) and therefore can give no details. The remaining twenty seven all showed complete duplication of the renal pelvis and grades of ureteral duplication varying from a bifurcation close to the kidney to a complete supernumerary ureter with a separate orifice and all but two were operated upon because of a pathological process located in the anomalous kidney. In the two exceptions cases of Stammler and Josephson the operation was undertaken merely on account of the incontinence produced by the supernumerary ureter opening externally there being no lesion in the kidney itself.

Josephson's (17) patient was a girl of eighteen who had had incontinence since birth due to a supernumerary ureter opening near the external urethral orifice. After a correct diagnosis he was able to cure the incontinence by exploring a left double kidney and resecting the upper portion which was about the size of a hen's egg leaving *in situ* a lower normal portion the size of a normal kidney. In Stammler's (18) case there was bilateral double ureter each anomalous ureter opening into the vagina and in accordance with Weigert's rule draining the upper pelvis of a double kidney on either side. Both kidneys were explored. On the right side the anomalous ureter was sectioned and ligated and the two renal pelvises anastomosed. On the left side an anastomosis was considered inadvisable on account of the small size of the upper pelvis and therefore a part of the upper half of the kidney was resected. The incontinence was cured.

In all of the remaining twenty five cases the operation was undertaken on account of a pathological condition which was primarily confined to one segment of a double kidney and in all but four (Lange 19 Chute 6 Lunck 21 Pilcher 2) the remaining segment was normal at that time of operation. There

were seventeen cases of pyonephrosis (four complicated by stone) four of tuberculosis three of hydronephrosis and one of acute surgical kidney (Lange). It is of interest to note that in nineteen instances (practically 80 per cent) the pathological condition was located in the upper segment. In four the lower segment was involved in another both segments while in the remaining one the seat of the disease was not mentioned. In two instances (Steiner and Franke) the operation was pyelotomy. Steiner (23) drained a pyonephrotic sac involving the lower portion of a double kidney. Franke (24) drained a hydronephrosis of one pelvis of a double kidney and divided an anomalous artery which was the cause of the obstruction. In Scudders' (5) case that of a child twenty months old there were acute symptoms produced by a huge dilated supernumerary ureter which ended blindly. Merely an exploratory operation was done the child dying soon afterward.

The possibility of an erroneous diagnosis due to an anomalous ureter is nicely shown by the case reported by one of us (Young 26) in 1903. The patient a man of 54 with a history of pyuria of several years duration and who had had one attack of left sided renal colic with passage of calculus two years before admission showed as a result of ureteral catheterization clear normal urine from the left kidney and purulent urine from the right. The X ray plate showed a large calculus in the region of the right kidney with no shadow on the left. With a negative X ray examination and normal urine from the left side the conclusion was that the left kidney was normal and therefore a right nephrotomy with removal of calculus was done by Dr Finney the patient dying two days afterward from anuria. As revealed by autopsy the left ureteral catheter had happened to enter the normal branch of a bifid ureter which led to a lower normal kidney segment. The upper half of the kidney was pyonephrotic and contained a large calculus which was not revealed by the X ray examination because the plate had happened to be placed too low. In Figure 2 a drawing by Mr Broedel of the autopsy findings the

limits of the urea covered by the X ray plate are indicated by a slightly darker tone. The mistaken diagnosis was therefore dependent upon curious co-existent pathological and anomalous conditions taken together with two unfortunate incidents. If the catheter had entered the other branch of the bifid ureter purulent urine would have been obtained instead of normal urine and if the X ray plate had been placed higher the large calculus would have been discovered. At that time pyelography had not been introduced.

The remaining twenty one cases of double kidney were all nephrectomies and in all but one (Albarran 7) the operation was complete nephrectomy. In three of them (Lange Chute Linck) the second portion of the kidney was said to be obliterated, functionless and hydronephrotic respectively and Pilcher's case showed a double pyonephrosis the lower pyonephrotic sac being the larger and containing a stone. The removal of this double kidney reported by Dr Louis S. Pilcher was the last operation done by Dr Paul M. Pilcher before the development of the pneumonia which caused his death. Nephrectomy in these four cases was undoubtedly the method of choice. Sixteen of the double kidneys however were half normal and would have afforded an opportunity for partial nephrectomy with preservation of a normal portion. The cases were those of Brewer (25) Bruci (29) Dumitreanu (30) Dobrotworsky (31) Floderus (3) Heyman (33) Key (34) Kusnetzky (35) Marion (36) Martin (37) Rafin (38) Summers (39) Stolz (40) Tschudy (41) Wille (42) and Wulfi (43). In this series of twenty one nephrectomies the diagnosis of ureteral duplicity was made before operation in two instances only while in nineteen the condition was accidentally discovered during the course of the operation or later by an examination of the pathological specimen.

There remains the case of Albarran the only one in the series in which the normal portion of the kidney was preserved. We find Albarran's brief mention of this case in the transactions of the ninth session of the *Association française d'urologie* (1905) in a discussion following a demonstration by

Nicolich of a pathological specimen showing a supposed persistent muellerian duct in the male. In this discussion Albarran considered the specimen of Nicolich to be in reality one of supernumerary ureter opening into the prostatic urethra and he then briefly described a similar case of his own in which he had removed the upper half of a double kidney for pyonephrosis. Apparently there was no stone. The operation was undertaken to cure a renal fistula resulting from a previous operation and the abnormality was discovered accidentally and not by previous diagnostic methods. Albarran has made no official report of this case but we quote his brief remarks in their entirety in the following literal translation.

The patient was a young man of 6 years who in Italy had had a nephrectomy for pyonephrosis resulting in a fistula which discharged a small amount of urine and much pus. During the operation which I undertook to cure the fistula I found two kidneys the one above the other both firmly adherent and demarcated the one from the other by a furrow. The upper kidney the smaller was almost destroyed by the pyonephrosis. After having cut the renal tissue at the level of the furrow which separated the two kidneys I extirpated the superior kidney which had an independent pedicle together with its pelvis and a portion of the ureter very dilated and thin. I do not know where the ureter ended below but it certainly did not go into the bladder which I have carefully examined with the cystoscope.

It is unfortunate that we have no illustrations and no adequate record of this case. As to the exact condition found at operation the presence or absence of stone the cause of the pyonephrosis the point of junction of the two ureters and as to the convalescence and the ultimate result we are not informed.

We find a brief mention of three operations upon presumably similar cases by Brunsch (44) as follows. Bisection of such a kidney was performed successfully in three instances by W. J. Mayo after the clinical diagnosis had been made. Other than this one sentence no further report in this country has been found.

#### CONCLUSIONS

The case reported above is apparently unique in that it is the only such case to be found fully reported in the literature.

The condition of double kidney and ureter is not rare and the upper half is most often the seat of disease its surgical importance is therefore great

The advent of ureteral catheterization radiography and pyelography has made the diagnosis easy and we should expect the discovery of more cases in the future

The radical cure by excision of the diseased half of the kidney with its pelvis and ureter is undoubtedly the method of choice

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## SUPERNUMERARY AND SINGLE URETERS OPENING EXTRAVESICALLY<sup>1</sup>

E S JUDD M D POCHETER MINNESOTA

THE ureter arises as a process from the posterior wall of the lower end of the wolffian duct. Its distal end divides normally into two branches which grow into the blastoma of the kidney. Each branch then divides and subdivides and forms the straight and uniferous tubules and calyces. Early in embryonic life the proximal end of the ureter opens into the lower end of the wolffian duct but under normal conditions at about the sixth week the ureter and duct separate and open separately. If the ureter does not become detached from the duct and accompany it in its downward course the ureteral opening may be found in any one of the organs developing from the urogenital sinus. If the wolffian duct and the ureter fail to shift before the urorectal septum forms in the cloaca the ureter opens into the rectum. Apparently this condition is very rare. I have not been able to find it mentioned except in reports of the foetus otherwise abnormally developed. If the ureter continues its association with the wolffian duct it empties into one of the organs developed from the duct such as the vas deferens seminal vesicle ejaculatory duct or Gartner's duct.

Furniss has reported a case of supernumerary ureter with an extravescal opening. He abstracted an article by Hartmann of Copenhagen who has analyzed 37 cases collected from the literature 14 of which were supernumerary. In these 37 cases the extravescal openings were distributed — 6 in the urethra 8 in the vagina 1 in the vestibule of the vagina and 2 in Gartner's duct. Hartmann's

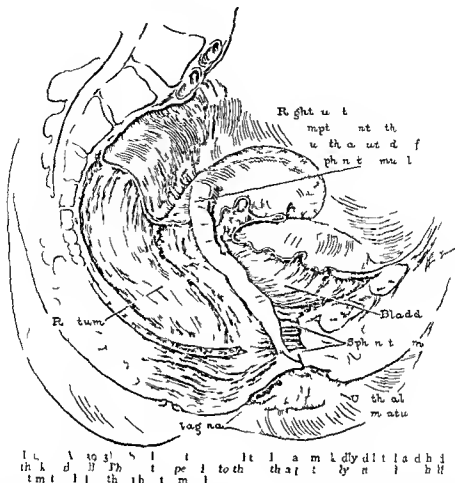
review shows that the abnormal opening whether from a single or from a supernumerary ureter most often occurs in some part of the vagina. In such cases in the embryo the ureter maintains its connection with the muellerian or wolffian duct. However it very seldom empties into the fallopian tube or uterus. Such abnormalities are reported to have been found in the foetus in a few instances.

If the ureter does not become separated from the wolffian duct the opening may occur in the urethra or in the vestibule of the vagina and apparently this is the embryonic abnormality which occurs most frequently.

It is possible that this abnormality is much more common than we are led to believe from the cases reported in the literature and may be explained by the fact that it is usually very difficult to make a diagnosis of the condition even though the clinical features are almost always suggestive. The 37 cases reported by Hartmann apparently included all the cases in the literature at that time (1913). In 14 of these the opening was that of a supernumerary ureter in the remaining 23 the ureter was single or the exact condition was not determined. Furniss also abstracted an article by Hartmann of Leipzig who had collected 16 cases of positive supernumerary extravescal ureters 12 cases of uncertain supernumerary extravescal ureters and 7 cases of a single ureter opening extravescally.

Kelly and Burnam describe one case in which a single ureter opened into the urethra. Five other observers reported cases of a single





ureter opening into the vagina and three reported cases of supernumerary ureters with openings in the vagina. Peacock reports a necropsy on a child nine months old that had four ureters, one of which terminated in the vesicoprostatic urethra.

I wish to add to the cases in the literature reports of two cases, one in which a single ureter opened into the urethra and one in which the supernumerary ureter opened into the vagina.

A clinical history of constant incontinence of urine associated with periods of normal urination suggests the existence of a ureter with an opening outside the bladder sphincter. Such a history was characteristic of both of our cases. In the patient having a supernumerary ureter this history had been constant from birth up to 18 years of age at which time she was operated on elsewhere

and obtained complete relief. Her symptoms returned six years later during her first pregnancy although the incontinence was not so regular or typical as it had been previously. For several days and sometimes for weeks there would be no leakage when she would have a period of incontinence. Following delivery her condition improved and during her second pregnancy the symptoms returned and persisted until she was operated on.

Our second case was that of a girl 2 years of age. The ureter opened into the urethra and she had had incontinence as long as she could remember. There is one point of unusual interest in the history of this patient apparently for long periods there would be no leakage at night and at times no soiling during the day. We were unable to explain this until at operation a greatly dilated and thickened ureter was found which seemed to

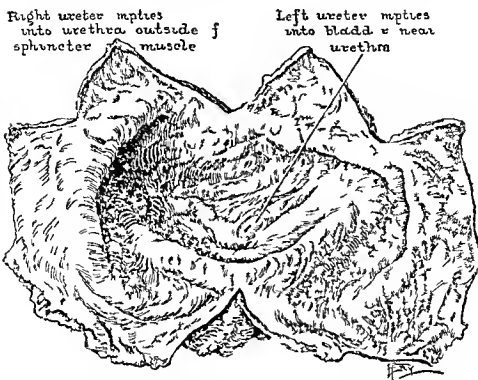


FIG. 2 (3163923) Probable appearance of a bladder having only one ureteral meatus near median line and just above urethral sphincter

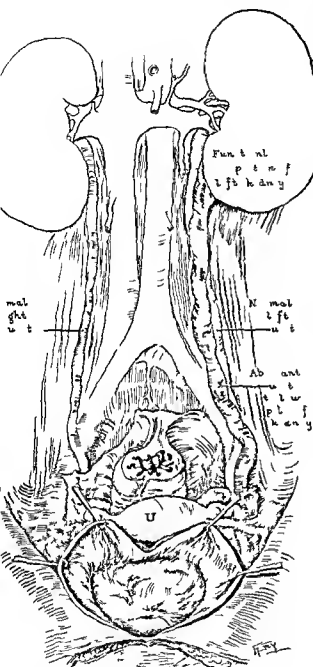
indicate that it had been obstructed at times and that there was considerable infection in its walls. Infection was naturally to be expected in this type of ureter in spite of the fact that the urine collected before operation showed only a small amount of pus. Soon after operation a large amount of pus was found in the urine but this gradually cleared up. Before operation the patient had three attacks of acute pain in the right side probably due to an inflamed appendix although it was possibly caused by the infection in the kidney and ureter.

In addition to these two cases a number of cases of urinary incontinence have been treated especially among young girls in which we were not able to determine the etiology. In some the condition was probably due to a low grade inflammation of the bladder, obscure nervous disorder or to a relaxed bladder sphincter, very uncommon among young unmarried women. It is also possible that in some instances the incontinence was due to a ureter with an extravasical outlet although the opening could not be located at the time of the examination. In our examinations in order to locate the

abnormal opening we have employed methods very similar to those described by Furniss.

The suggestion of a single ureter is substantiated by a cystoscopic examination which shows the absence of the other. In our case the ureter was located very close to the bladder sphincter but it could be seen distinctly. Even if there is a supernumerary ureter the cystoscopic examination may reveal a normal bladder with normal meatus and normally functioning kidneys, as in one of our cases. If an extravasical opening is suspected and cannot be located we have found it helpful to place pledgets of cotton in the vagina and urethra and over the meatus of the urethra injecting subcutaneously and intravenously some sort of dye which colors the urine as it is eliminated. If the extravasical opening does not discharge continuously it may be necessary to repeat the procedure several times.

Treatment consists of implanting the true ureter into the bladder. This has been done in several ways most often I think by vaginal operation. In some instances a small sac has been found at the lower end of the ureter and has caused some difficulty in operating.



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In the case of the supernumerary ureter herein described Dr Maxon of California had previously performed a vaginal operation. The ureter had been freed in the vagina an opening made in the bladder over a sound

and the ureter drawn into it. The operation had completely relieved the patient and undoubtedly she would have remained well if changes had not been produced by the pregnancies some years later. The stretching of the tissues had altered conditions so that at the time of our examination it was impossible to determine the area of implantation. We felt sure that this ureter had been closed continuously for long periods and that it would be very difficult to reimplant it on account of the scar therefore the supernumerary was ligated with satisfactory results.

Under ordinary circumstances however it is my opinion that the procedure of choice is the abdominal extraperitoneal implantation of the abnormal ureter. This was done very satisfactorily in our second case in spite of the fact that there was considerable infection in the ureter. The technique of the abdominal operation is more accurate and the implantation may be made with a better chance of preserving the lumen of the ureter and therefore the function of the kidney. We have sufficient evidence to show that ureters transplanted in this manner will continue to functionate and maintain a normal kidney function over a number of years. We have recently examined two patients in whom the ureter had been transplanted four years previously and in both instances the adjoining kidney was practically normal. In our two cases under discussion the incontinence was relieved immediately and relief has been permanent.

CASE 16393 M L a single woman age 37 consulted us June 7 1906. The menstrual history a normal. She complained of dribbling of urine which had troubled her all her life. She had had nocturnal urination when she was young but not recently. She complained of constipation and stated that when her bowels moved freely or followed by physical she had very little or no trouble. The dribbling of urine was not constant but on exertion caused her to escape. Previous to one year before examination she had had three attacks of sharp colic like pain in the right side of the abdomen each of them lasting from one to two days. The attacks of pain were followed by soreness and the physician who saw her in the attacks told her they were due to appendicitis. In repeated examinations of the urine considerable pus was found and cystoscopic examination showed some inflammation in areas at the left base. The ureteral meatus o

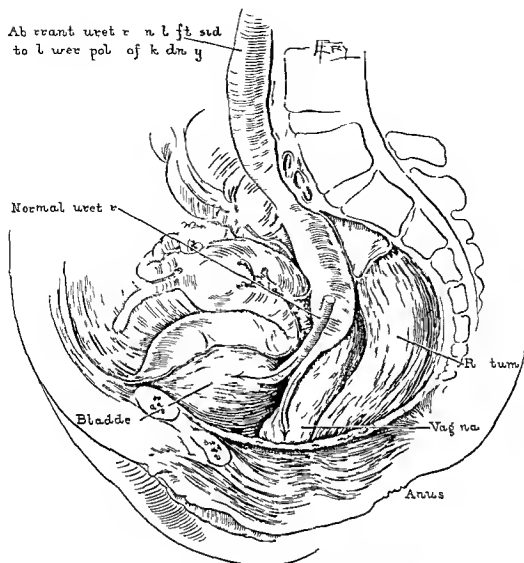


Fig. 4 (1977 b). The lower end of the normal and upper end of the supernumerary ureter as normal in its diameter for one and one half inches where it became markedly dilated as far as could be determined.

the right side could not be found the left meatus situated just inside the internal sphincter muscle on the left side appeared to be entirely normal and clear urine was seen coming from it. The bladder sphincter was apparently relaxed and it was thought that this might account for the incontinence (Figs. 1 and 2).

**Operation.** The sphincter was tightened by folding it upon itself and by taking a few stitches but this did not relieve the symptoms. Ten months later the patient returned for an examination at which time her history was typical of extravesical ureter. She had incontinence and dribbling of urine and in addition voided normally from three to five times daily. It was necessary for her to wear a pad constantly.

Cystoscopic examination at this time showed a left ureteral meatus situated just inside the bladder sphincter. On withdrawing the cystoscope an apparently normal meatus was found in the right

wall of the urethra 1.5 centimeters outside the bladder sphincter. The right ureter was normal in length.

The right ureter was exposed through a right rectus extraperitoneal incision. The ureter was greatly dilated and thickened. It was surprising to find such marked infection in the wall of the ureter which of course was positive indication that the kidney was infected. However we decided to implant the ureter and if necessary to perform a nephrectomy later.

A few days after the operation the patient had considerable pain in the region of the right kidney and there was pus in the urine. Two ureteral catheters were readily passed into the pelvis of the kidney and continuous pelvic lavage was instituted. From this time on the pain decreased. The wound healed promptly although there was slight urinary drainage from it for a few days. The incontinence ceased after the operation and she has had no fur



## MIXED TUMORS OF THE SALIVARY GLANDS

A STUDY BASED ON THE EXPERIMENTAL PRODUCTION OF NEOPLASM IN THE SUBMANDIBULAR GLAND OF THE DOG<sup>1</sup>

BY ALEXANDER FRASER, M.D., NEW YORK

A. P. P. H. I. L. J. D. B. H. Hosp. I. M. d. I. C. I. g. I. A. t. i. P. H. I. t. S. t. V. t. H. o. p. t. I.

THE theories of origin of the mixed tumors of the salivary glands may be classified as follows:

1. *The endothelial* This theory which is the most widely accepted of all postulates that the tumor cells are derived from the endothelium of so-called lymph spaces or lymph vessels and that the myxomatous tissue and cartilage are derived by metaplasia either from the connective tissue of the stroma (Virchow) or from the tumor cells themselves. This view was fostered by Volkmann (1) and has since received the support of nearly all writers except those of the French school. More recently it has been revived and advocated by von Hansemann who claims he has traced the development of an enchondroma to a lymphangioma and by Martin (2) who thinks he can see the continuation of the tubular structures with proliferated endothelium of the lymph vessels.

*The embryonic (de l'embryone juxta salivare)* of Forgue and Massabau. According to these authors the mixed tumors of the salivary glands should be classed with those of the testicle i.e. they are embryomata. There is little evidence for this theory and it has few supporters.

2. *The branchial theory* The presence of cartilage and bone in these tumors had already suggested a possible connection with the cartilage of Meckel (Virchow and Rehn) and even with the cartilage of Reichert (Hinsberg). Cunco and Veru (3) developed the theory of their origin from vestiges of the branchial clefts. This theory is viewed favorably by F. C. Wood (5) in his excellent paper on the subject published in 1904 and has recently been resurrected by Chevassu (6) under the name *d'encelome*. It would seem however that this view has thus far attained little more than the status of an

hypothesis unsupported by definite facts either pathological or embryological. Masson and Peyron (7) point out that the genetic line between the branchial inclusion described by Veau and the tumors to which they are supposed to have given birth has never been observed and call attention to essential morphological differences between structural elements of the mixed tumors and those of the true branchial tumors which are of comparatively rare occurrence. On the embryological side they bring forth many considerations which go to show that this theory not only has no embryological basis but that there are many facts which tend to exclude it.

3. *The theory of origin from adult epithelium of the salivary glands* This is the theory which has been most widely advocated by French writers. It was first presented by Perrochaud in (8) 1883 and was supported by Voyer and de Larabrie (9) Collet (10) and de Ponsot (11) Berger, Morestin, Mulherbe and Puller. Up to the present time facts in support of this view have not been established and there are several objections to it chief among which are its failure to explain the presence of cartilage in the tumors and the fact that the tumors are usually encapsulated and show no connection with the glandular structures.

4. *The theory of origin from embryonic glandular germs* Pittance in 1895 was the first to suggest that the mixed tumors might arise from portions of the embryonic salivary gland which having lost their connection with the ducts remain dormant as undifferentiated tissue. Such rests could at the same time develop pavement and glandular epithelium. Wilms (12) modified this theory by assuming that the rest concerned should be a tissue not of one order but of two a so-called ecto-mesodermic rest. A similar



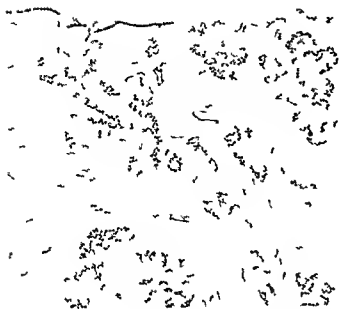


Fig. 2 Outgrowths from cyst wall in Dog 1. Cyst wall at top



Fig. 3 One of the alveoli in Dog 2 showing outgrowth of epithelium through the basement membrane

ment of the enamel organ in which they see an exactly similar transformation to that taking place in the mixed tumors. The primary cells of the tumor according to Masson and Peyron are derived probably

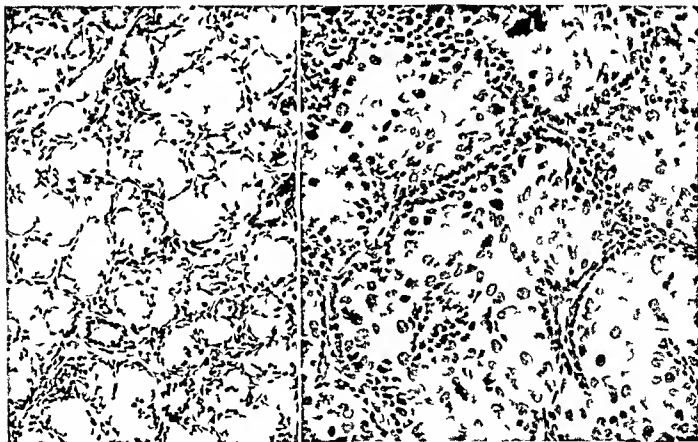


Fig. 4 (at left) Portion of alveolus showing proliferation of the basket cells of the alveoli (Dog 3)

Fig. 5 Section from human mixed tumor of parotid (Case 1, Group 1) showing alveoli with two types of

cells, the inner large cells and the outer cells with deeply staining nuclei. Note the proliferation of the latter outward to the stroma and compare with that shown in Fig. 4



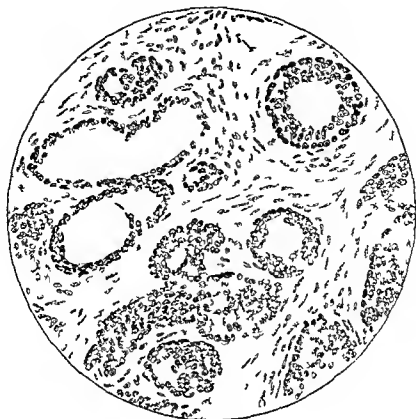


Fig. 1. Small cysts and solid masses. (H. E. stain, 100x magnification.)

### HISTOLOGY

The cyst walls are lined by epithelium which varies in character in different situations. In some places there are two layers, an outer cuboidal and an inner tall cylindrical. Sometimes this cuboidal layer approaches the cylindrical type, i. e. the nuclei are oval and stand with their long axis at right angles to the basement membrane. In other situations the cuboidal cell is flattened and look like endothelial cells. In still other portions of the same cyst wall the inner cylindrical layer is absent and the cuboidal cells extremely flattened thus giving the cyst the appearance of a lymphatic vessel. There are also remarkable features in the proliferative tendencies of these cells. In places the cuboidal cells have become spindle or oval shaped and are seen growing down through and for some distance below the basement membrane in broad sheets simulating a type of small spindle

cell sarcoma. More frequently however the epithelium of the cyst wall extends outward in stout budding finger like processes which terminate in groups of large tubular or solid alveoli which are round or oval in shape and sometimes branching into tortuous intricate labyrinths of cells. These structures are lined externally by an even row of cuboid cells with deeply staining nuclei. Some of them are tubular and have an inner lining of large spheroidal cells with a large amount of acidophilic cytoplasm and large round or oval moderately chromatic nuclei. These cells evidently correspond to and represent a modified form of the cylindrical cell of the cyst and the solid masses are evidently formed by their proliferation inward (see Figs. 1 and 2). This whole picture which has as its most striking peculiarity the prominence of the even row of deeply staining cuboid cells at the periphery of the alveoli is remarkably similar to that of the alveolar

structures found in one of the mixed tumors of the parotid to be described later. In most of these structures there is a distinct structureless basement membrane immediately external to the layer of cuboid cells but in some of the secondary buds and in some isolated alveoli this membrane is broken by the outgrowth of the outer row of cells which spread outward for some distance into the surrounding tissue (Fig. 3). In several places prolongations from these outgrowths can be traced directly into encapsulated collections of epithelial masses which probably represent the sites of lobules or groups of lobules of the gland. These latter are surrounded by thick fibrous capsules which send extensions between and around the contained epithelial masses of which some are solid while others are tubular in structure and in shape round oval or elongated branching or more properly 'budding'. Between them or in their neighborhood can be seen in some places the faintly staining framework of the glandular acini the meshes of which are filled with small basophilic granules (serous granules) and frequently accompanied by numerous mononuclear phagocytes and occasional giant cells.

The cells of these epithelial growths vary in character. Frequently the differentiation of the peripheral and the central cells stands out prominently by the deep staining of the former two or three tiers of which are flattened and elongated and sometimes grow out in thin winding strands following the course of the framework of the glandular acini. In many of the masses the cells are chiefly of the squamous type and the whole structure simulates a cut off interapillary

down growth in early epithelioma of the skin. In others the cells are smaller and several perfectly round lumina appear in the mass giving it the so called cylindromatous appearance so frequently seen in tumors of the salivary glands. In still others especially in the smallest masses there is no distinct basement membrane the cells are chiefly of the basal type and radiate from the center to the surrounding tissue simulating another structure frequently found in salivary tumors. Besides these solid structures there are

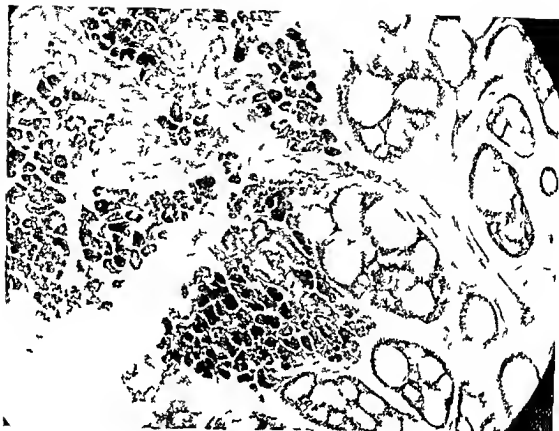


Fig. 10. Interlobular ducts (D<sub>0</sub> 3) showing proliferation of outer germinal cell. Note mitoses.

others which are distinctly tubular and frequently lined by two distinct layers of epithelium an outer cuboidal and an inner cylindrical another feature which is characteristic of the structures found in the mixed tumors.

The gelatinoid areas observed macroscopically correspond histologically to destroyed lobules containing large quantities of seromucoid secretion.

In several lobules which have been affected but not destroyed an interesting picture is observed. The inner layer of cells lining the acini has disappeared and the lumina are filled with mucin. The interesting feature is the marked change in the outer layer of so called basket cells. These cells which



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are a continuation of the outer cuboidal layer of the ducts and which probably represent the germinal epithelium of the gland normally are barely noticeable as very much flattened nuclei just inside the basement membrane of the acini. In these lobules in which the cylindrical cell of the acini have disappeared and the lumina are filled with a clear substance which does not stain with hematoxylin and eosin the framework of the gland lined with these proliferating basket cells stands out very prominently (Fig 4). The cells are markedly increased in number and the nuclei which have acquired a spheroidal or more frequently a spindle shape radiate from the stroma with their long axes frequently at right angles to the basement membrane. This framework with its surfaces more or less thickly coated with these proliferating deeply stain-

ing nuclei is remarkably similar to the stroma of the alveolar structures in Case I (Group 2 of the mixed tumors studied (see Fig. 5). In some of the lobules the basket cells have proliferated so abundantly that they fill the lumina of the acini thus transforming them into solid masses of small deeply staining spindle cells and in a few places they have grown outward through the basement membranes in diffuse sheets simulating closely small spindle cell sarcoma (Fig 6).

In one of the cases in which aniline was injected into the duct and the latter ligated under the mylohyoid muscle a small portion of the gland which had escaped destruction by the aniline showed two or three nodular outgrowth which histologically were of an adenomatous nature. The acini assumed the form of tubules lined with large epithelial cells with a large amount of dense basophilic

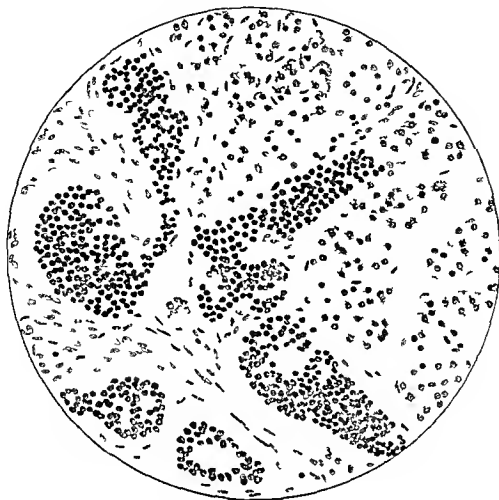


FIG. 1. Section from parotid tumor (Case 2, Group 1) showing neoplasm occupying the site of interlobular ducts and extending into normal lobule on site of an interlobular tubule. At two points of junction with the acini the cells of which contain darkly stained serous granules.

cytoplasm. Some of the tubules were large and showed invaginations or papillary in-growths of their walls. Here too the basket cells showed though in a lesser degree the same characteristics as in the lobules above described.

The areas of preserved glandular tissue show practically normal gland. The interesting feature is that they are separated from the affected areas by thick bands of fibrous tissue.

It is not claimed that the structures above described fulfill all the requirements necessary for classification as true neoplasms. Morphologically they are a few of those near the cyst wall are entirely new formations infiltrating the surrounding connective tissue (Figs. 1, 2, 3, and 7). The most of them however occur apparently on the site

of the destroyed lobules of the gland but they are new in the sense that they are not what was there normally. They are not like the normal acini and ducts. They are evidently formations produced by proliferating ducts but they are atypical enough in morphology and number to be regarded as neoplastic (Figs. 8 and 9). It is realized however that in order to justify their classification as neoplastic the indefinite persistence of their growth would have to be proved and this proof is not forthcoming from the results of our experiments with their present limitations.

But the purpose of the experiments was not to produce neoplasm but to observe the behavior of the salivary epithelium in the process of reaction to injury and to note whether the changes occurring bore any

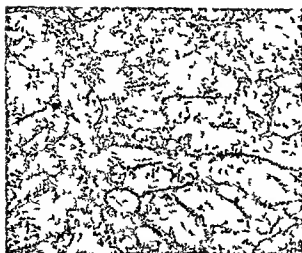


Fig. 3. C. n. m. t. al. l. f. m. (a. t. f.)  
Not in m. n. e. a. l. l. f. t. l. t. m. a. l. l.  
o. t. e. r. l. l. l.

resemblance to those represented in the elementary structures observed in the parenchyma of the mixed tumors. The essential features of the changes observed may be summed as follows:

1. The remarkable regenerative power of the ducts.

The coming into prominence of two layers of epithelium in the lining of the ducts and the retention of the differentiation in the new formations (Fig. 10).

3. The tendency of the inner cylindrical layer to grow inward in solid masses of large epithelial cells (Fig. 1) and of the outer cuboidal to grow outward through the

basement membrane in smaller polygonal or out shaped forms simulating cell of the basal layer of the skin (Fig. 6).

4. The development of apparently entirely new formations in the shape of epithelial outgrowths from the cyst walls both as pavement and as glandular structures.

5. The marked tendency to encapsulation of the affected portions of the gland as a consequence of which they are completely separated by a thick band of fibrous tissue from the preserved or uninjured portion.

In regard to (2) that is, the two layers of duct epithelium, it may be called to mind that this is the normal structure of some portions of the ducts though it is seldom seen in ordinary sections and not mentioned in many textbooks on histology. Krause in describing the sublingual gland of man (which description is to include the parotid and submaxillary ducts) says: "the large ducts are lined by a double layer of cylindrical epithelium. Further inward we have a layer of moderately high cylindrical cells covered by a bright red (Biondi stain) cuticular band underneath which we see a single layer of cuboidal cells." Further attention is called to this fact because of its obscurity and hence of its being overlooked in the consideration of tumors of the salivary glands and because a double row of cells forms one of the most striking characteristics of the parenchymal structure in all the mixed tumor studied in this work.

H. I. I. A. R. I. m.



Fig. 4. Sect. fr. m. typ. l. m. d. i. m. t. a. d. t. f. mat. l. l. b. l. l. r. cell. th. l. t. t.  
c. t. c. l. a. b. o. d. r.

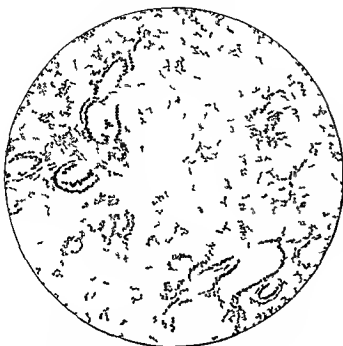


Fig. 5 Drawing of similar structures (Case 1 group 1) Note even row of outer cuboid cells and inner cylindrical layer with cuticular border

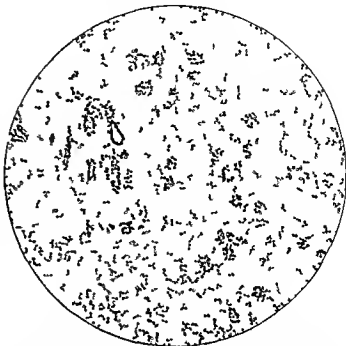


Fig. 6 Section from mixed tumor showing proliferation outward of the outer layer of cells. Early myxomatous change gives them a lighter appearance than that of the duct cells

**Salivary tumors** One of the tumors of the parotid studied shows in a few places in intimately intermixed glandular and pavement epithelial structures which fact together with the history of the case confirms its parotid origin. For the most part however the histology of the tumor is indistinguishable from a typical squamous cell epithelioma. One of the submaxillary tumors shows very similar histological features. Two of the parotid tumors are carcinomata with structural elements closely imitating the glandular acini. In none of these is there any history of metastasis to distant organs but there is extensive infiltration of the surrounding tissues and immediately adjacent lymph nodes. One of the parotid tumors is a large spindle and giant cell sarcoma apparently originating from the stroma of the gland. History of the case subsequent to removal of the tumor was not obtainable.

As these tumors do not show the classic features of the so called mixed tumors they will not be considered further.

**Mixed tumors** Of these there are in the collection studied 14 from the parotid and 2 from the submaxillary. The tumors show

at first sight considerable difference and might easily be made to fall into classes such for instance as those given by Wood and by Wilson and Willis but as will be shown these differences are superficial and of degree rather than of essential structure and classifications based on them can be of no real help to the pathologist. In the parenchymal structures for example tubular or solid types may predominate or the cells may spread out in sheets or the individual cells may vary in size and character being sometimes large and squamous like sometimes small and of the rodent ulcer or perhaps spindle cell sarcoma type and at other times cuboid or cylindrical or again the so called stromal or what are believed to be according to the results of this study secondary parenchymal changes may vary. By these we mean myxomatous and allied changes the development of cartilage and sometimes of bone. If however all parts of each tumor are carefully searched it will be found that they frequently show to some extent at least the same variations in structure and secondary changes as appear to characterize and distinguish the different tumors. For example microphotographs



Fig. 7 (left) S. I. f. m. m. d. m. l. f. S. I. 8. t. f. m. m. d. m. l. g. m. y. m. t.  
 cyst d. ct. m. to. tg. th. f. il. t. l. f. ll. f. l. t. k. pl. th. t. l. pot. f. p. th. l.  
 d. C. mp. d. l. pm. t. f. m. l. h.

from different sections from Case 1 (Group I) can be used to illustrate any of the features of the other cases with the exception of the presence of bone which is found in only one of our tumors. Or again at the first study and by the use of the hematoxylin and eosin stain alone the presence of cartilage could be confirmed in only two of the tumors but when further study was made by the use of special stains e.g. cresyl violet widely scattered groups of cartilage cells were found in 11 and the precartilaginous process as indicated by the presence of the cartilage matrix was evident in all.

However attractive the above indicated variations may be and however distinct the classes which they tend to create may seem I am convinced from a two years uninterrupted study of the mixed tumors in this collection that in all of them the parenchymal structures can be reduced to the same mor-

phological unit of origin and an attempt will be made to show that this unit is the salivary duct.

For the sake of clearness in the description of the tumors I shall deal with the *parenchyma* which will include only what are evidently primary structures and the *secondary changes* separately and without making a classification shall consider the tumors in two groups.

*Group 1* In this group there are four tumors.

*Parenchyma* The structure is uniform and consists of large and small masses of epithelium. The shape of the larger masses is round, oval or elongated and branching. The cells are uniformly small, round and basophilic suggesting in places the appearance of lymphocytes. The larger alveoli appear as solid masses which have within them numerous round or oval lumina which

frequently have no distinct lining of cells they are simply holes in the centers of cell accumulations. These holes are frequently filled with a bulging like substance which gives a positive mucin stain (Fig 11). This is the type of structure which Borst and Wood give in their drawings as cylindroma. The smaller masses are round or oval in shape and may be solid or tubular in structure. The tubular forms are usually lined by two rows of cuboid cells but occasionally by an outer cuboid and an inner cylindrical layer.

In many places in these cases lobules of the gland are well preserved but between them interlobular ducts cannot be found. In their places we see tumor masses and a most interesting result of the study of this group is the fact that in 3 of the cases direct and indubitable connection of these tumor masses with the gland can be demonstrated. Furthermore it can be seen that these points of connection correspond to the junctions of the interlobular and intralobular ducts. It is clear from the sections that these connections are not attained by a process of infiltration but that the tumor masses are developed by a proliferation of the epithelium of the ducts. In Figure 12 from Case 1 is shown one of these connections with one of its short branches directly continuous with an acinus of the gland. Where the acinus commences is well brought out by the basophilic serous granules in the cytoplasm of the cells. These are not present in the tumor cells. Figure 11 Case 1 shows another such connection. Several intralobular ducts are seen uniting at the periphery of a lobule and becoming continuous with one of the large cylindromatous masses of the tumor. Occasionally near these tumor masses sometimes in the center of a group of them is seen a large widely distended duct with a thinned out wall giving the appearance of dilatation from obstruction. The acini do not play any part in the neoplastic process. The only change they show is atrophy from compression by the expanding tumor masses and probably from obstruction of their ducts.

Though this type of parenchymal structure is the only one observed in these four tumors



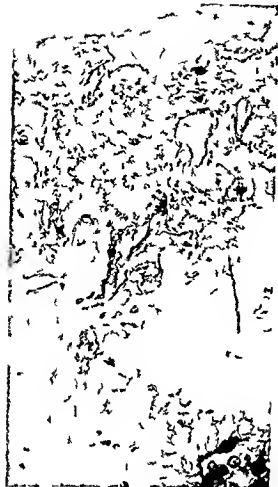
Fig. 10 A typical picture of the salivary mixed tumor showing duct structures with the characteristic double row of cells myxomatous change and developing cartilage cell

this fact cannot justly form the basis for a classification for the same type of structure is found in some of the tumors in Group 2 which also show the usual polymorphism of the mixed tumors.

*Secondary changes* In this group the secondary changes are few and unimportant. There are no cartilage cells present and there is no bone formation. There are however limited areas of myxomatous and allied changes among which is the disposition of a substance which by its staining affinities appears to be the same substance as forms the cartilage matrix in the tumors of Group 1. In these myxomatous areas the tumor masses become thinned out and the cells flattened and elongated. When this change becomes extreme the neoplasm assumes the appearance of long winding thin strands of elongated flat cells growing out through the myxomatous matrix in a manner to suggest endothelial formations.

*Group 2* In this group are 11 tumors and





I g I m I m I m I m I m I g  
som f h l l l l d t f f m l

they are considered together because of their fully developed polymorphism and secondary changes. As stated above two of them are not only representative of the structure of their own group but of the cyndromatous formations characteristic of Group 1 as well and sections from these chiefly will be used in illustrating the histological features of the whole group.

*Parenchyma* In some of the members of this group we may find large microscopic fields occupied by sheets of small polygonal, oval or spindle shaped cell interspersed here and there with spots of myxomatous tissue looking very like myxosarcoma but it would be an error to consider such a field as representative of the primary struc-



I g I m I m I m I m I m I g I g  
pe t f l m t f m t

ture of the tumor. On the contrary we must try to find where the cells originate and if all parts of the tumor are carefully studied this can be determined in each case. In all the cases without exception what is evidently the primary structural unit is an epithelial formation either solid or tubular which has a definite basement membrane and shows two types of cells in outer cuboidal layer and inner cell which vary in character according to whether the formation is tubular or solid.

If the formation is solid the inner mass of cells may vary some in size and staining qualities but most frequently they approach the squamous type are arranged somewhat concentrically and occasionally show true pearl formation.

The cells of the solid alveoli however though large are not always of the malignant type. In one of the tumors of this group (Case 1) are areas containing alveoli of exceptionally large cells which both in

their character and arrangement suggest a carcinoma of acinar origin rather than an epithelioma (Fig 13). In these alveoli on account of the contrast effected by the large amount of clear cytoplasm of these inner cells on the one hand and the small evenly set hyperchromatic nuclei of the outer cuboid cells on the other these latter stand out more prominently than in any other parts of the tumor. And as these cuboid cells proliferating in a manner to be described later form a peculiar looking hyperchromatic border for the stroma of the alveoli a picture (Fig 5) is presented which is decidedly similar to that of the changes found in the acini of some of the gland lobules in the experimental cases previously described. Furthermore by the use of serial sections of the particular areas under consideration it has been demonstrated that these solid alveoli of large cells are directly continuous with and constitute the terminations of the adjacent distinctly tubular structures and that they are formed by proliferation and modification of the inner cylindric epithelium. Even in single sections transitional structures and points of continuity can frequently be seen. These particular alveoli then as the above facts would indicate are probably an atypically accomplished attempt on the part of the duct like structures to form glandular acini.

If the structure is tubular the inner cells may consist of one layer of cuboidal and one or more layers of cylindrical cells. Not infrequently can be seen a tube which is lined by an outer layer of evenly placed cuboid cells and an inner layer of tall cylindric cells covered by a broad inner cuticular border which stains a deep red with eosin in short a typical representation of portions of the normal salivary ducts (Figs 14 and 15). Sometimes the cells of the outer layer are flattened representing possibly certain portions of the normal duct in some instances and in others the effect of pressure by proliferating adjacent cells. At other times and quite frequently so they assume a short cylindric type due evidently to a release of pressure brought about by softening of the basement membrane and external tissues

as a result of myxomatous degeneration. The cells of the inner layer too undergo various changes but most frequently an extreme flattening as an effect of pressure by a so called colloid substance which accumulates in the lumen of the tube and which stains pink with eosin and varying shades of red with metachromatic stains such as cresyl violet. The successive steps of transition from the tall cylindric type to that of flat endothelial like cells are frequently demonstrable in a single microscopic field. As a result of a combination of the above mentioned changes one can frequently see tubular structures lined by perfectly flat endothelial like cells from which radiate outward a row of moderately tall cylindric cells structures which constitute one of the most constant and most striking features of the histology of the mixed tumors and probably the feature which has played the most prominent part in suggesting the endothelial origin of these neoplasms (Fig 21).

Sometimes the solid masses undergo a change which gives them the appearance of tubular structures viz by necrosis of the central mass of cells. The central necrotic material becomes homogeneous and stains pink with eosin thus giving the appearance of colloid within a tube. Many have thought this to be the mode of formation of all the tubular structures found in these tumors but that this is not so can be positively determined by the use of special stains and by the fact that the tubules are lined by an inner layer of cylindrical epithelium which frequently shows the deep red cuticular border characteristic of the inner cells of the salivary ducts.

When this central necrosis takes place the peripheral epithelium is compressed and there is left the appearance of a tubular structure lined by rather flattened epithelium arranged concentrically in several layers. This constitutes the so called lymph or hemangio endotheliomatous structure of the advocates of the endothelial theory.

As the solid masses are developed from a primarily duct like formation by a growth inward of the inner layer of cells so other characteristic appearances of the parenchyma

are developed therefrom by a growth outward of the outer cuboidal cells. This outward growth may take place simultaneously with the formation of the solid structure or alone. An early stage of this proliferation of the outer cuboid cells is shown in Figures 5 and 1. These cells grow through the basement membrane and spread out in sheets until they meet with similar outgrowths from the neighboring tubular structures. As they grow outward they become less deeply staining and may undergo various changes in size and shape so that the microscopic field as a whole presents the appearance of tubular or solid structures without basement membranes embedded in a diffuse mass of cells which may show all grades of difference from the cells of the original structures (Fig 10). In Figure 17 is shown the cells of the outer layer of the wall of dilated duct formation proliferating outward and assuming the appearance of the cells of a basal cell epithelioma. As they spread further out they present the picture of a small spindle cell sarcoma. This change in the character of these cells has led to the belief that they are of separate origin from the more definite structures which they surround that is that they are developed either from the stroma or from the second germ in a bigger minimal embryonic rest. Or again the picture sometimes suggests the differentiation of mesothelium from mesenchyma in the development of the convoluted tubules of the kidney. It is quite possible and in some tumors quite probable that new solid and tubular formations of embryonic type and without basement membranes are developed from these cells somewhat in this latter way but a careful comparative study of many sections of such tumors leaves no doubt that the cells themselves are epithelial and that they are derived primarily from previously formed duct like structures in the manner above described.

It is in these cells that myxomatous and allied changes to be noted later usually take place and these are most marked farthest away from their ducts of origin. And when as before stated the inner cell layer of a duct becomes flattened out by secretion (colloid)

and only a few tiers of the proliferated outer cells have escaped the myxomatous change we have presented to us one of the most common and most characteristic pictures found in the mixed tumors of the salivary glands viz an apparently endothelial lined tube with several rows of cells radiating outward from the wall. This is the so called lymph or hæmangioepithelioma of the supporters of the endothelial theory.

In addition to the formations already described as characteristic of the salivary mechanism there is present in one of the tumors of this group and that in one of the most representative ones Case 2 a type of structure which points strongly to a parotid glandular origin. In this tumor there are numerous groups of tubules which on cross section present a very similar picture to that of the normal intralobular ducts of the parotid gland. These tubules are lined by tall cylindrical cells presenting a dark inner and light outer zone with the nucleus situated at the junction of the two. The light outer zone shows line striations radiating outward at right angles to the basement membrane. These are the rod cells of Heidenhain which are the characteristic cell of the parotid intralobular ducts. Some of these structures are solid and others show a clearing of the central cells representing the early stage of lumen formation. A few structures of this type are found here and there in some of the other cases and might be regarded as merely accidental appearance but in this tumor they are so numerous and so arranged in groups that there can be no doubt that they are definite primary structure.

In none of the members of this group have direct connections between the neoplasm and glandular lobules been found as in Group 1. Remnants of normal gland are present here and there in some of the cases but definite relations with neoplastic structures are not in evidence. In four of the tumors however are large cysts beneath the capsule of the neoplasm which from their double lining of cuboid and cylindric epithelium are evidently dilated ducts and the epithelial outgrowths from these strongly suggest that they may be the structures from which the

neoplastic process originated. This suggestion is heavily reinforced when these cystic developments are compared with the exactly similar processes which have previously been described in connection with some of the experimental cases.

In these latter as before stated the outgrowths from the cyst walls are evidently entirely new formations and not merely regenerations of old structures and if what is morphologically neoplasm is experimentally developed in this way it is justifiable to infer in the case of the tumors under consideration that the presence of similar cystic formations indicates for them a similar manner of origin.

As in the experimental cases so in these tumors the cells of the cyst wall are frequently compressed and flattened out so as to resemble a single layer of endothelium and consequently the structure can easily be and frequently has been mistaken for a lymph vessel. And this undoubtedly accounts for the clam by numerous writers that they have demonstrated the development of the mixed tumors from lymph vessels in the tumor capsule. The true nature of the cyst however can be determined by the finding in some parts of its wall or in that of other cysts near by the two characteristic layers of epithelium an outer cuboid and inner cylindric. Martini and other advocates of the endothelial theory have always noticed these distinctly epithelial lined structures associated with the so called endothelial tubes and they interpret their lining cells as embryonic forms of endothelium but they can hardly claim that embryonic endothelium is ever cylindrical with sometimes a distinct cuticular border and above all that it should so constantly take the form of the peculiar double row above described. This is the structure of the salivary duct and no other.

*Secondary changes* I have already noted the marked changes which take place in the parenchymal cells changes which amount to a true metaplasia. I shall now describe some further changes which are prominent in the members of this group a group of changes which play an essential part in

making up the histological complex which distinguishes the salivary mixed tumors as a class.

*1. Cylindroma* Not infrequently we see a group of ducts filled with 'colloid' and surrounded by a more or less broad rim of hyaline substance. This is the picture which Adam and others call cylindroma and it is quite common in the tumors of Group 1 as well as in those of Group 2. The peripheral change is brought about in probably several different ways as is indicated by the different staining qualities of the hyaline material in different places. For example in some places it stains red with picrofuchsin while in other places it stains brown like colloid and in some places it stains red with cresyl violet and in other places green. In some instances the appearance is due to fibrosis and hyalinization of the surrounding stroma in which case it stains red with picrofuchsin. In other instances it may arise through a colloid type of degeneration of proliferated epithelial cells at the periphery of the ducts while at other times the hyaline rim appears to be a structureless substance deposited between the outer layer of epithelium and the adjacent connective tissue in short it occupies the site of and looks like a very much broadened basement membrane. This peripheral change occurs not only around duct like or tubular structures as above described but also around the solid epithelial masses or columns. As the hyaline substance increases in amount it encroaches on and replaces the epithelium of the mass or tubule from without inward until finally nothing is left but thin rings or strands of one or two rows of epithelial cells which give the appearance of being somewhat irregularly stuck in this highly refractive and structureless substance. Throughout the course of this change the double row of cells which I have before emphasized as the most constant characteristic feature of the primary structure of all these tumors tenaciously persists and is apparent though somewhat changed in both the rings and strands. In the former the inner layer is frequently flattened from compression by the internal mass of colloid and the outer one appears as spindle

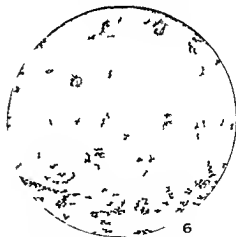
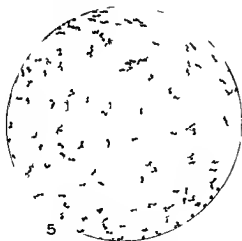
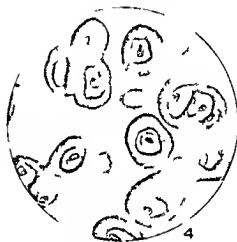
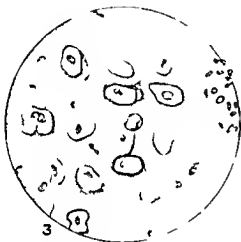
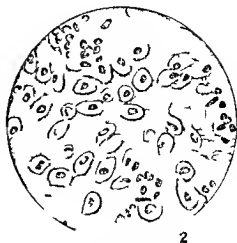
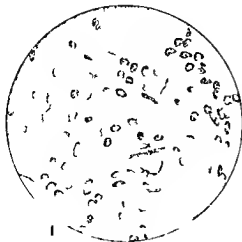
shaped nuclei arranged perpendicularly to it and radiating outward. As before stated this picture represents a stage in the so called peritheliomatous formations which have formed a basis for the endothelial theory. As above stated this type of cylindroma phenomenon may be produced by different changes but in the instances in which the process advances to the extent just described it is evidently of the same or at least of a closely allied nature with those to be described later under the head of myxomatous and cartilaginous changes.

2 *Myxomatous change* This change so common in the mixed tumors is usually spoken of as taking place in the stroma or connective tissue an error which I think is due to the fact that the change has been studied after its completion and not in its early stages. When more or less large areas of myxomatous change are present and especially as they are most frequently situated between tubular or solid masses of epithelium they do undoubtedly suggest at first sight that they correspond to the site of what one would naturally suppose to be the stroma of the tumor. But if we study other areas with similar arrangement of the primary parenchymal structures which have not yet undergone to any extent myxomatous change it becomes evident at once that the intervening spots which correspond to these myxomatous areas (in the former place) are not occupied by connective tissue elements but by dense sheets of epithelial cells which have grown outward from the periphery of the tubular structures. It is in these sheets of peripheral epithelial outgrowths which have been previously described that myxomatous change is most frequently found. But not uncommonly it occurs in the central portion of the solid epithelial masses spreading out and toward the periphery. In one of the tumors of this group this is the usual site of occurrence (see Fig. 18) and is so to some extent in several others. In this case the picture reminds one very strikingly of the changes in the medial layer of epithelium in the developing enamel organ. Without entering into cytological details the main steps of this myxomatous change may be

epitomized as follows: (1) The cytoplasm of the cell becomes replaced with a substance which consists partly of a homogeneous non-stainable and probably fluid substance and partly of very fine filaments which stain faintly ambophilic with hematoxylin and eosin and varying shades of red with cresyl violet. (2) This substance becomes extracellular and appears in the same forms (homogeneous and filamentous). (3) The cells as a result of (1) and (2) undergo various changes in morphology; the cytoplasm is vacuolated or the cell membrane may appear distended and bulging; the cells become more or less widely separated by the pressure of the extracellular substance; the cell membrane is drawn out at various points into long strings which seem to be continuous with groups of the above noted filaments and with similar processes from neighboring cells while the nuclei become small, crenated and distorted in shape. Stained with hematoxylin and eosin the earliest stages of the change present the familiar appearance of intra- and extracellular edema of the epidermis and this appearance when occurring in connection with tubular structures constitutes one of the chief features on which is based the diagnosis of nearly all so called endotheliomata.

3 *Cartilage* Though at least a few cartilage-like cells are found in all the members of this group it is present in large amounts in only two, viz. the submaxillary tumors. With ordinary stains such as hematoxylin and eosin when the cartilage cells are few or in the early stages of formation their presence is easily overlooked or not at all detectable. But with cresyl violet which stains the capsule deep red and the cell areolae and matrix from different shades of red to reddish violet they are easily picked out from the other tissues and this stain is of great value in helping to determine just how and from what particular cell the cartilage develops. In regard to the development it may be stated at the outset that there is no evidence whatever in any of these tumors that the cartilage develops from perichondrium either in the capsule or in the stroma of the tumor. On the contrary it is clearly evident in all



[illegible]

that the process of cartilaginous formation originates and develops exactly in the same situations and in connection with the same elements as does the myxomatous change viz in the epithelium of the tumor parenchyma. When the cresyl violet stain is used the first fact that engages the attention is the remarkable diffuseness of the process it being found in some stage of its progress throughout practically all parts of the tumor. This fact alone seems enough to contradict the theory of origin from an embryonic rest of chondroblasts inasmuch as on this theory we would expect to see growth by extension from one center whereas as a matter of fact we see the change in all stages of its development arising from innumerable widely separated primary foci. The steps of the process in the formation of cartilage do not appear to be exactly the same in all the tumors or even in all parts of the same tumor though in all probability the differences noticed are superficial rather than essential. Two such apparently different forms of the change are observed.

1 *Direct metaplasia* This is the form observed (almost exclusively) in the submaxillary tumors in one of which there is a large amount of cartilage and a considerable amount of osteoid tissue. The change takes place in the sheets of epithelial cells which have proliferated outward from the peripheral cuboid cells of the primary tubular or solid structures. Stained with hæmatoxylin and eosin the first indication of the change is a vacuolization of the cytoplasm as is seen in intracellular oedema. Later to this appearance is added separation of the cells or the picture of extracellular oedema. The appearance is exactly like that seen in early myxomatous change but the process is not so extensive. Stained with cresyl violet the first thing noticed is a reddening of the epithelium. This is due to accumulation in the cell body of a red staining substance which surrounds and obscures the nucleus. Later this substance becomes extracellular and separates the cells a process exactly similar to the myxomatous change but in this case the red staining substance is homogeneous or composed of filaments which are closely packed

together whereas in the myxomatous change it is always filamentous with the filaments widely separated. At this stage when this red matrix is still intra as well as extracellular viewed with a low power lens the cells are only faintly visible and the difference in appearance of the affected area from that of the surrounding epithelium is very marked. We can hardly get away from the suggestion that we are looking at tissue which is entirely different and distinctly marked off from the epithelial masses between which it lies. But if we view the picture with a high power or better oil immersion lens we can see that this red homogeneous mass contains many cells which are still of the same character as and form a continuous sheet with the surrounding epithelial cells the only difference being that they are covered over and obscured by this reddish substance. And furthermore we can at the same time positively determine that besides these there are no other cells in this matrix (see Plate Fig 1).

The next step in the process consists of an increase in the density of the extracellular and a disappearance of the intracellular substance so that the cells again become distinctly visible. They now appear as nuclei surrounded by a small or moderate amount of cytoplasm which in turn is surrounded by a broad clear rim or halo (see Plate Fig 2). The succeeding step is represented by an intensification of the density and staining of that portion of the extracellular substance immediately adjacent to the cell membrane which now appears surrounded by a deep red rim that is the capsule of the cartilage cell (see Plate Fig 3). The final step consists in the differentiation of the cell areole and general matrix (see Plate Fig 4).

This metaplasia is not confined to the outwardly proliferated cells in which it commences but gradually advances and involves the primary tubular or solid structures though these are by far more resistant to the change. These are frequently changed *en masse* so that when the metaplasia is completed they are represented by rings or solid alveoli of cartilage with much the same arrangement and inter relations as they



possessed in their former epithelial state of existence. There is no evidence of nuclear division in the fully formed cartilage cells. They represent apparently an end product. In the epithelium from which they are developed however mitoses are seen and frequently amitotic division of the nucleus resulting in the formation of two or three nuclei in the cells which are returned after their transformation into cartilage cells.

Specific stains show the presence of a few collagen fibers and a few to a moderate number of elastic fibers in the cartilaginous areas. They are most numerous about the periphery and can be traced as extensions of the corresponding fibers of neighboring foci of stroma.

*Indirect metaplasia.* In this form the cartilage formation develops apparently as a terminal step in the myxomatous change. It is exhibited extensively in the tumor (parotid) of this group which contains the second largest amount of cartilage. In this tumor cartilage is not present in large compact masses. The whole tumor which measures 10x9x6 cm. is largely made up of small nodules which macroscopically look like cartilage but have not its consistency—they are soft. Histologically these nodules are lobules of epithelial alveoli which have undergone myxomatous change with the formation of a varying number of cartilage cells. The only apparent difference between the cartilaginous and the myxomatous changes seems to be that in the latter the metachromatic substance thrown out by the cells exists in the form of fine filaments which are accompanied and widely separated by a clear non-stainable fluid substance whereas in the former it is homogeneous or in filaments closely packed together. Probably the physical effect of the non-stainable fluid may account for the filamentous form of the metachromatic substance for as the fluidity disappears the latter becomes more homogeneous. In fact it is something like this that happens when cartilage cells are formed as a sequence of the myxomatous process. It can be observed that around a cell here and there the metachromatic threads are

increased in number and lie closer and closer together until finally they form a homogeneous mass (see Plate Figs 5 and 6). In one stage of this metamorphosis the cells appear to be buried in a mass of radiating filaments that resembles one end of a sheaf of wheat. Later this mass becomes homogeneous and the further steps in the process of metaplasia are the same as those already described in the direct form.

4 *Bone formation.* Bone or rather osteoid tissue is present in only one of the tumors and this is apparently the only instance in which the stroma plays any part in the neoplastic growth. In numerous places in the centers of groups of cartilage lobules evidently on the site of what was originally the main stroma and vascular channels of the tumor there is a more or less successful attempt at formation of medullary canals. At the periphery of these canals in place can be seen rows of poorly formed osteoblasts with here and there an osteoclast externally to which is deposited a layer of osteoid tissue (see Fig. 20).

#### SUMMARY AND DISCUSSION

1. The mixed tumors arise from the ducts of adult glands. No claim is made that true neoplasm has been experimentally produced but the experimental results justify the conclusion that the primary structures of the mixed tumors may easily arise from the ducts of the adult gland. Facts established by the morphological study of 14 mixed tumors such as the connections of tumor and gland in Cases 1, 2 and 3, Group 1, as well as the cystic formations and their outgrowth in Case of Group 1 practically prove the point.

Undoubtedly many of the histological phenomena in these tumors look odd and at first sight puzzling and as is our custom when thus puzzled we are inclined to seek refuge in the embryonic realm. I have frequently shown sections of these tumors to experienced embryologists but none of them seemed to recognize in them any structure with which he was familiar.

2. The endothelial theory has no foundation in fact. All the so-called endothelial structures are easily explained as natural

f l b p y lam h d m g d h d c r  
h l b p h l f l f h

modifications of primary duct formations. The most common one viz the perithelioma tous formation is a figment without histological basis for it is now generally agreed among histologists that the perivascular lymph space from the endothelium of which it is supposed to arise is not a lymph space lined with endothelium but merely a tissue space to facilitate the expansion and contraction of the vessel.

3 Injury such as localized or partial obstruction of ducts probably plays a prominent part in the origin of these tumors. Facts are accumulating daily in support of injury as a prominent factor in tumor production. Witness the Mayo records of the relation of gastric ulcer and cancer, the recent experimental production of a metastasizing tumor by the application of tar by Yamigawa and Ichikawa (15) the bladder tumors in aniline workers and numerous other like instances. The most common precursor of cancer of the breast, chronic cystic mastitis or diffuse fibroadenomatosis is a condition very similar to the one produced in the dog's submaxillary gland.<sup>1</sup>

4 The cartilage is developed from the

I h t dy p d d th i dt m lh m ph j g ly  
gl d f nm t h i f w h w lb po t d f rh m g  
p bl t

epithelium of the parenchyma of the tumor. This claim will undoubtedly meet with strong opposition but I am compelled to let the facts stand as above reported.

I wish to thank Dr Douglas Symmers and Dr Charles Norm for their kind co-operation in this work. I also acknowledge my indebtedness to Dr Charles Goodman and Mr A. V. Frewitt for skilful aid in the surgical work.

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## CYSTS AND PSEUDOCYSTS OF THE PANCREAS

WITH REPORT OF CASES

BY A. A. KERR, M.D., SALT LAKE CITY, UTAH

THE term pancreatic cyst has been used to describe any fluid tumor in or a society with that organ though such tumors differ in etiology position and clinical manifestations. Cysts occurring in the upper abdomen are rare compared with cysts rising from the pelvis. The organs from which the cysts may arise are the pancreas, the kidneys and the suprarenals, the liver and the gall bladder.

In the differential diagnosis the following affection will be considered: (1) the malignant disease of the pancreas or of the adjacent organs; (2) aneurism; (3) echinococcus cysts of the liver, spleen or peritoneum; (4) affections of the retroperitoneal lymphatic glands; (5) hydronephrosis or pyonephrosis; (6) cystic disease of the suprarenal capsule; (7) circumscribed peritonitis with exudation; (8) cysts; (9) cystic disease of the ovary; (10) hydrops of the gall bladder.

Malignancy usually occurs in patients more than fifty years of age although it may appear in a much younger patient. Large pancreatic cysts are unilocular but if a malignant tumor has undergone degeneration more than one cyst may be found. Hardness and irregularity of surface suggest malignancy; smoothness and regular round or oval contour speak in favor of a cyst. Occasionally a rapidly growing pancreatic cyst may develop much more rapidly than malignancy.

**Aneurism.** An aneurism of the abdominal aorta can be distinguished from a pulsating pancreatic cyst as its pulsations can be felt in all directions and a bruit is present. If the patient is placed in the genupectoral position by gravitation the tumor will leave the aorta and all pulsations will cease. Steadily pressure will diminish the size of an aneurism but will have no effect on the cyst.

**Echinococcus cysts of the liver or spleen** may be mistaken for cyst of the pancreas. A peculiar fremitus which is sometimes felt on

palpating an echinococcus cyst should always be sought. Hooklets in the aspirated fluid would be a positive indication of echinococcus cyst while their absence would not exclude the possibility of the tumor being a sterile echinococcus cyst.

**Tumors of retroperitoneal lymphatic glands.** Inflammation, neoplasms, suppuration or enlargement of the retroperitoneal glands posterior to the pancreas might simulate a pancreatic cyst but such conditions would usually give rise to serious constitutional disturbance and to extension of the disease to neighboring organs.

**Hydronephrosis or pyonephrosis.** In pyonephrosis there may be an enlargement simulating a tumor but there is tenderness (readily elicited by percussion with the Murphy method) and intermittent fever with pyuria. In hydronephrosis urinalysis shows usually albuminuria, ovalate of calcium and crystals of uric acid. The specific gravity is usually low and the urine is generally alkaline or neutral in reaction. Cystoscopy with catheterizing of the ureter will assist in the diagnosis. Hematuria is rarely seen except in cases of calculus. The X-ray should be used as routine in the diagnosis of the condition. Tumors of the kidney usually occupy a lower place and are more laterally situated than tumors of the pancreas.

Laboratory pan-tur is condemned by modern surgeons in the diagnosis of this type of tumor.

**Cystic disease of the suprarenal capsule.** The bronze skin is suggestive of disease of the suprarenal capsule. The blood pressure is usually low. About eight months ago I was called to see a doctor about 52 years of age who was suffering from severe gastric symptoms, persistent vomiting and a slightly bronzed hue to his skin, no palpable tumor. On his temporarily recovering he left for Los Angeles where he had a home although he was

practicing in Salt Lake City. Later advice from his attending physician showed a recurrence of his symptoms with a very low blood pressure. He improved temporarily on giving him solution adrenalin chloride but he died a few weeks later. Autopsy showed cancer of the suprarenal gland and in addition carcinoma of the stomach.

*Circumscribed peritonitis with exudation*  
Pancreatic cysts usually occupy the lesser peritoneal cavity or omental bursa. In circumscribed peritonitis there is usually fever, pain and tenderness which is more acute than in a cystic growth. Leucocytosis is generally found on examining the blood. Ascites is usually easily differentiated although a cystic tumor filling the whole abdomen is sometimes misleading.

*Cystic disease of the ovary* Several cases are reported of a large pancreatic cyst having been mistaken for ovarian cyst. About two years ago I was consulted regarding an old lady about 70 years of age suffering from a large cystic tumor filling the entire abdominal cavity. The history and physical signs pointed to its origin being in the left side of the pelvis. She refused operation and died a few weeks later. I secured permission to perform a partial autopsy which showed a large cystic tumor filled with thick gelatinous fluid originating from the left ovary and extending up to near the diaphragm. This tumor might have been mistaken for a cystic tumor originating in the upper abdomen or for an ascites.

*Hydrops of the gall bladder* Hydrops of the gall bladder is located more to the right side and is attached to the liver.

The material upon which investigation of pancreatic cysts has been founded has been rather scant. In the majority of cases dealt with surgically a cyst has been opened, stitched to the abdominal wall and drained. This has seemed to the operators to be the most prudent and desirable thing to do to minimize the mortality. Museum specimens of pancreatic cysts are rare; there is no doubt that in some cases when all the signs physically and chemically have been elicited the cystic tumor has only a secondary connection with the pancreas. These have been



FIG. 1 Location of the pancreatic cyst in the author's case.

described by Korte as pseudocysts, peripancratic cysts.

Pancreatic cysts may be classified as (1) retention cysts (2) proliferation cysts — cystic adenoma, cystic epithelioma (3) hydatid cysts (4) congenital cystic disease (5) hemorrhagic cysts and (6) pseudocysts. The last form is not a true pathological classification but a convenient clinical term.

#### RECENT LITERATURE

Hirsh and Wedder<sup>1</sup> report a true cyst of the pancreas. At the operation the cyst was found in the lesser peritoneal cavity and was free from adhesions, being attached by a pedicle to the head of the pancreas. After removal the wall of the cyst was found to contain pancreatic tissue and its contents showed the presence of enzymes.

Korte<sup>2</sup> reports six cases of inflammatory pseudocysts treated by marsupialization. Symptoms simulating gall stone colic were elicited in these cases.

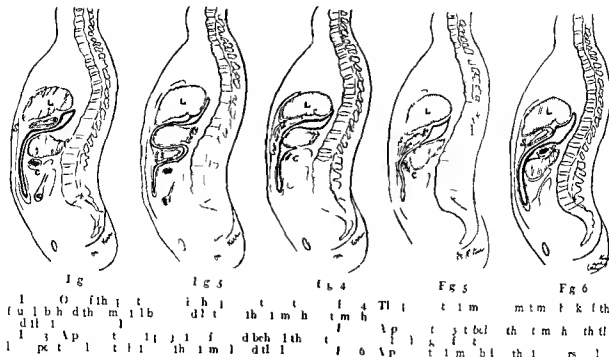
Dobson and Telling<sup>3</sup> have published a description of a pancreatic cyst lined with cylindric epithelium in a child of eleven.

Conolly<sup>4</sup> found a large pancreatic cyst in an infant 14 months of age.

In one case of pancreatic cyst reported by Albert and Page the cyst emerged to the right through the foramen of Winslow into the greater peritoneal cavity.

Johnson relates a case where the cyst appeared in the left flank simulating a hydronephrosis.

Vellut<sup>5</sup> in his work on the pancreas gave records of 13 cases operated upon by evacuation and drainage in two stages. All the patients recovered but one died later of diabetes and in some a fistula persisted for several months. The opening and draining of the cyst had been done in 15 cases with deaths.



Se er l p t i e n t d i e d l a t e r f r m d i a b e t e f o t l  
 e x t i r p a t i o n h a d b e e n p e f o m e l n 6 s i t h  
 d e a t h s B e l e s t h e s e 6 c a s e s f h y l a t e d c y t o f t h e  
 p a n c r e a s h a v e b e e n p e r a t e d u p o n i t h n o f a t a l t i e s  
 P a n c r e a t i c c y s t s a r e a b o u t e q u a l l y f r e q u e n t i n  
 m e n a n d w o m e n T h e g r e a t e r n u m b e r f s e a r e  
 s a i d t o o c c u r b e t w e e n o n d 4 0 y e a r s (O c c a s i o n a l l y  
 c y s t s a r e a s s o c i a t e d w i t h p a n c r e a t i c a l c u l i  
 L a s c i t e a t c a s e t h h i s t o r y o f a u m a

**Causes** Opie says The presence in cystic content of one or more enzymes resembling those of the pancreas was formerly believed to give proof that a cyst had its origin in the pancreas. Frequently all of these enzymes are absent in the contents of a pancreatic cyst whereas fat splitting diastase or proteolytic enzymes are found in fluid not derived from the pancreas.

**Symptoms** The symptoms depend more on the size and location of the cyst. Stomach symptoms are frequent. A rounded slightly fluctuating tumor in the epigastrium in close relation to the stomach is suggestive. The tumor varies in size often being the size of a child's head and sometimes it may fill the entire abdomen. There is usually weakness and loss of weight. Diabetes is occasionally present as in the case I report. It showed per cent glycosuria.

According to Korte cysts of the pancreas may occupy a variety of situations depending upon the relation of different part of the gland to surrounding organs.

**Variety of situations of pancreatic cysts**  
 1. In most instances the cyst growing forward presents upon the abdominal wall between the stomach and the colon being covered by the gastric colic omentum which must be divided at operation. Pseudocysts are said to occupy this situation.

A cyst arising from the upper border of the pancreas may push its way between the lesser curvature of the stomach which is pushed downward and the liver being covered by the gastrohepatic omentum.

3. The cyst especially when it is situated in the tail of the pancreas may grow into the mesocolon separating its layers. If the cysts distend the upper layer of the membrane the colon is pushed downward and the tumor during life is found between the stomach and the colon. If the lower layer is distended the transverse colon may be found along its upper border.

#### PROGNOSIS AFTER OPERATION

John on watched seven cases all with postoperative fistulae. All healed some drain.

ing as long as three years. One of the cases under my observation during the last year was operated upon about fourteen years ago in Los Angeles. It is still draining from the fistula.

#### SUMMARY

Pancreatic and pseudopancreatic cysts while not rare are of sufficient importance to be recorded.

The X ray is an important aid in diagnosis in showing the position of the cyst in relation to the stomach and other organs.

The treatment is surgical usually incision and drainage. Sometimes it is practical to remove the entire cyst in favorable cases.

Diabetes is an occasional complication of pancreatic cysts and when present renders the operation more dangerous although one should not hesitate when less than 4 per cent of sugar is present (C. H. Mayo) after giving a diabetic diet and a course of alkaline treatment to minimize the acidosis to give even these the benefits of operations.

An antidiabetic diet is advisable following operations on the pancreas especially where the discharge is irritating. Itraffin ointments are serviceable to allay the irritation.

**CASE 1.** Mrs. F. age 55 Irish parentage native of America widow seven years occupation house work mother of three children. The patient's father died at the age of 95 the mother at 80. Two sons died of cancers one having cancer of the breast and one having carcinoma of the neck. She had six brothers and seven sisters four brothers and two sisters died young one sister died of pneumonia.

**History.** About 10 years ago the patient had a rather severe trauma as she fell down two flights of stairs. She states that some swelling in epigastric region developed after the fall. The patient was first seen in August 1916 when a tumor in the right epigastric region was found. She then went on for six months before consenting to operation. By this time some pressure symptoms had developed she complained of gastric fermentation and indigestion when temperature and pulse were about normal. She complained of some weakness at times. A roentgenogram was taken by Dr. C. W. Stewart which showed the tumor lying to the right of the stomach in the upper right side of the epigastric region. Examination of the urine showed 1 per cent glycosuria. The patient was admitted to the hospital January 24 1917 and operated on January 26 1917. An incision about five inches long was made over the most prominent part of the tumor the cyst was exposed. The walls were sutured to the

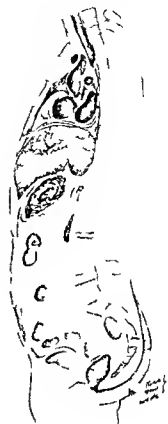
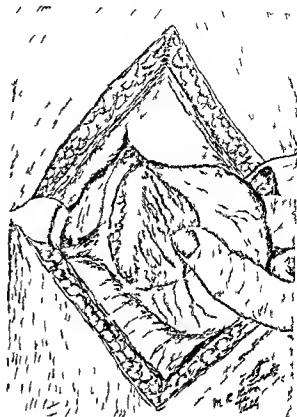
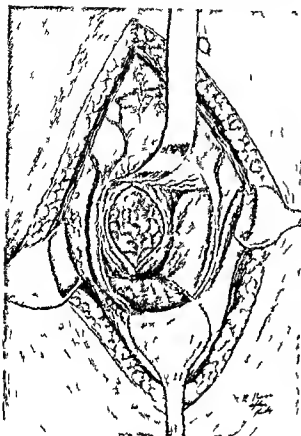


Fig. Normal relations of the liver, stomach, transverse colon, and the duodenum.

parietal peritoneum. The contents were then evacuated; it contained about one gallon of a dark red colored fluid. A drainage tube was inserted and the wound closed. The patient stood the operation well. Dr. J. Gribbin examined the fluid contents of the sac but found no pancreatic enzymes. The patient made a satisfactory temporary recovery and left the hospital February 5 1917. The wound still discharging some. The sugar in the urine disappeared temporarily under strict diabetic treatment while in the hospital. On one occasion after being at home for about two weeks her daughter reported that some hair discharged from the wound. About two months later the discharge was quite copious and believing that I could freely expose the cyst without danger I decided to reoperate and drain in the right flank. Accordingly she was readmitted to the hospital. This time the cyst wall was freely exposed the bowels being first carefully packed off. As much of the cyst as was possible was resected the large drainage tube was inserted coming out in the right side underneath the liver. This operation caused a marked improvement in her condition though there is still a slight discharge from the fistula. The patient is now able to walk several miles and is comfortable.

The pathological report showed the cyst wall to be of the nature of a teratoma.

**CASE 2.** Mr. F. age 34 American married father of children occupation weighmaster in



18 Report of the following case

1801 (the following)

Carfield Smelt. His father being and in fair health. The father had been operated upon for what is thought to be gall stone but no other found. The mother died of some trouble one sister and one brother are living and well.

History. The patient is healthy as good until about 1903 at which time he is taken with colic like pain and vomited considerably. He was then living in Los Angeles. Dr. George Lasher of that city operated on him and found that as diagnosed as the pancreatic cyst the cyst attached to the abdominal wall. Drainage has persisted ever since but does not prevent the patient from working. It does cause him considerable inconvenience about half a pound of fluid discharged daily from the fistula.

A sample of this fluid as sent to the University of California Laboratory for analysis. The sample submitted for examination presented the following as reported by Dr. A. Blumberg and unpublished

color dull gray, pH 6.5, 10% reagent alkaline albumin 0.5 percent, leucocytes not reduced alkalinity 5 percent, pressed by vacuum meter of tannin normal hydrochloric acid with alkalinity due to carbonic acid in 30 percent proteolytic lypolytic rennet distinctly proteolytic and amylolytic nature.

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 To. v. d. m.  
 R. v. d. M. D. f. t. e. l. a.  
 J. M. O. S. M. I. D. gnos.  
 K. E. v. d. N. E. Gyn. c. l. p. y. and Abdom. I. S. y.  
 Br. v. d. Oper. u. Surg.

# CONGENITAL RANULA OF THE TONGUE DEVELOPED IN THE LEFT BIANDIN-NUHN GLAND

By Dr. RAMON TIJADA AGUIRRE GUATEMALA, CENTRAL AMERICA

CAREFUL observation in the case reported below has enabled me to form certain conclusions in regard to ranula of the tongue

A native of Guatemala age 13 without any hereditary or personal antecedents of importance showed a congenital tumor of the tip of the tongue ovoid in form and measuring 6 centimeters long 4.5 centimeters broad and 3.5 centimeters high. On inspection the tumor appeared translucent with the upper surface smooth and normal in color for the most part although bluish and black in places especially about the middle where there is an irregularly shaped ulceration with thick and callous edges and a reddish center which easily bleeds. The under surface of the tumor smooth lustrous and yellowish shows the two ranular veins of large volume with numerous branches. On palpation the tumor appeared resistant and slightly fluctuating. Aspiration drew some drops of thick white viscous fluid without odor and with the characters of a mucous fluid.

On account of the large swelling the patient could not keep her tongue within the mouth moreover owing to its weight and projection the lower incisors were loosened and pushed outward also undoubtedly owing to the fact that the mouth had been kept open for a long time the condyle of the lower jaw

had formed two neoarthroses in front of the glenoid cavities i.e. two true irreducible luxations of the mandible owing to which the patient as seen in Figure 2 could not approximate the dental arches thus leaving a semi ovoid space between the two arches measuring 2 millimeters in its greatest width.

On this account and because of the excessive size of the tongue the functions of this organ as well as those of the neighboring organs were defective and liquid food only could be taken. Mastication in the true sense of the word was impossible and the patient in addition to liquid food could eat only soft substances which could be made into a paste by the working of the tongue against the palatine arch. Deglutition could be effected only with difficulty. Saliva dripped constantly giving rise to salivary hypersecretion. Owing to the constant moisture from the saliva on the patient's chin and breast there were two eczematous plaques which partly covered these regions. A very marked lisp was noted in the speech. The letter r was suppressed in words into which this consonant enters and rr was changed into j in others. The tongue worked slowly and with torpor. There was marked hyperesthesia in the organ in the region of the tumor especially when the patient took any warm liquid food but the patient suffered most from attacks of suffocation which came on in the night time when sleep was most intense.



Fig 1



Fig 2



Fig 3





This case not only disproves but absolutely destroys the theory of Tillman who says I think there is but one class of ranula always sublingual and primary and that the suprathyoid is only a prolongation or diverticulum of the same. It also disproves or contradicts Forgue who says with reference to ranula. It may be admitted that its origin is contrary to the theory of Recklinghausen according to whom ranula is developed in the Blandin Nuhn glands.

3 This case absolutely disproves the

idea that sometimes a lingual ranula as Tillman believes can emit a prolongation or diverticulum into the interior of the tongue as well as contradicting the opinions of Forgue and Cunco with regard to the formation of cysts in the tip of the tongue arising from thyroglossal embryonal remnants.

4 Our humble opinion is that besides the lingual ranulas the origin of which is described by Tillman Forgue and Cunco other lingual ranulas may develop at the expense of the Blandin Nuhn glands as the majority of authors believe and as the present case amply demonstrates.

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Cl. 15, 4, 7, 4

## GLOBOCELLULAR SARCOMA OF THE RIGHT TESTICULAR ORCHIDECTOMY UNDER LOCAL ANÆSTHESIA (ALLEN'S TECHNIQUE)

By DR. RAMON TEJADA AGUIRRI, GUATEMALA, CENTRAL AMERICA

**A**s malignant tumors of the testicle are so rare we would report the only case which we have observed during the past eight years.

A native of Guatemala, age 30, butcher married 12 years, came to consult me July 4, 1914. There were no hereditary or other antecedents of importance; he did not have syphilis, gonorrhea, tuberculosis or paludism. He never had hernia nor has he suffered from testicular traumatism.

His trouble began about 6 months ago and he noticed an increase in the size of the right testicle which by degrees reached the excessive size shown in Figure 1. Because of its weight the tumor produced a kind of dragging sensation in the cord and an intermittent pain in the lumbar region.

**Examination.** The patient is not emaciated and there is no abnormal tint to the skin. No adenopathy is present in the inguinal or other regions accessible to examination. There are no scurs or spots on the skin. In the scrotal region there is a tumor more globular than pyriform, which is 18 centimeters deep and 10 centimeters wide. Eruption of this tumor is not painful and discloses it to be soft in consistency, depressible, fluctuant in some regions and hard and resistant in others. Even with both hands it cannot be reduced within the inguinal canal; not the least sound of a gurgle can be detected. The surface of the tumor is quite smooth. Percussion shows absolute dullness in all parts. Testing for translucidity as in the case of

hydrocele the tumor is found quite opaque. As piriform puncture draws only a few drops of blood. All the other organs are apparently normal.

**Diagnosis.** The following affections are suggested: (1) irreducible inguinoscrotal hernia; (2) hydrocele of the tunica vaginalis; (3) traumatic hematocele; (4) syphilitic testicle; (5) chronic hemorrhagic vaginalitis or spontaneous hematocele; and (6) malignant testicular tumor. We immediately eliminate irreducible inguinoscrotal hernia of either the abdominal or abdomino-omental type owing to the solidity of the tumor. Besides an epiplocele would not attain the size of this tumor without containing a portion of the intestine and would consequently give a sonorous note on percussion. Likewise we eliminate hydrocele of the tunica vaginalis not only on account of lack of translucency (because it is known that there are opaque hydroceles due to the thickness of their wall or to the quality of the fluid contained) but especially because of the negative result given by exploratory puncture. Traumatic hydrocele is excluded as external signs of any recent injury to the scrotal region are wanting and the patient absolutely denies any traumatism. We can exclude syphilis of the testicle owing to the rapid evolution of this tumor which in a period of 6 to 8 months has attained dimensions which the syphilitic testicle never would reach in this length of time or only exceptionally in a longer period. Finally we discard without diagnostic discussion tubercular and other orchitides since the tumor shows no resemblance whatever to them. There remain only two testicular affections: pachyvaginitis



Fig. 1. Illustration of a large, pear-shaped, rounded mass, likely a tumor or cyst, with a narrow neck extending upwards. The left illustration shows a smaller, more irregular mass. The right illustration shows a cross-section of a mass with internal structures visible.

THE PRESENT STATUS OF THE SURGERY OF THE BILE TRACT<sup>1</sup>

## A BRIEF REVIEW OF THE HISTORY OF BILE TRACT SURGERY

By ARTHUR DAN BEVAN M.D. F.A.C.S. CHICAGO

THE history of bile tract surgery begins with the history of operations for gall stones

The existence of gall stones was known ever to Hippocrates and Galen. Occasional reports of incising gall bladders and removing stones were made as long ago as 1700 and 1800. Bobbs of Indianapolis did a cholecystotomy in 1867. However the real surgery of the bile tracts dates practically from the work of Marion Sims and Lawson Tait in 1878. In 1880 Langenbuch did the first cholecystectomy and in the same year did a cholecystenterostomy. In 1885 Charles T. Parkes of Chicago described fully the technique of choledochotomy but this was not successfully done until 1889 by Courvoisier and a few years later McBurney did a transduodenal choledochotomy.

The operation for restoring the common duct by various plastic operations is a recent development. It is interesting to note some of the mile stones in the development of this work. In 1884 in the *Journal of American Medical Sciences* W. W. Keen and John Musser published an article reporting 3 cases which they had banded jointly of removing stones from the gall bladder. They tabulated all the cases up to that time 85 in number. One of the concluding sentences in their article is the following: "After revising these 85 cases we are very much surprised and gratified at the low mortality from these operations the mortality being only 30 per cent." The progress made since that time probably in the same series of cases would today give a mortality of 3 to 5 per cent.

In 1898 in the Chicago Medical Society we presented a symposium on this subject in which the following men took part: Fenger, Senn, Billings, Hektoen, Herrick, McArthur and myself. I have lately reviewed that symposium and am surprised to find how

completely it represents the present knowledge on this subject. The advances made in the last 20 years have been principally in the way of refinements in technique and because of the experience gained in an enormous number of cases our ability to make more accurate diagnoses to decide for or against operative procedures and to better select the particular plan of treatment indicated in a particular case has been enhanced. In addition the one special improvement which has been made in this field has been in plastic surgery for the restoration of the common duct.

I shall not go into the subject of pathology and etiology of bile tract lesions. The conditions which demand surgical relief are gall stone disease, acute infections of the bile tracts, chronic infections of the bile tracts and neoplasms, especially carcinoma and lesions of the pancreas and other contiguous structures which either from invasion or from pressure interfere with the function of the bile tract. I desire especially to take up the subject of the diagnosis of these conditions and their treatment.

For the last 5 or 6 years my medical colleagues and I at the Presbyterian Hospital have been making a scientific clinical research of these conditions and have attempted as far as we could to place both the diagnosis and the therapy on a firm scientific basis and I shall attempt informally to present to you tonight the results of our investigations and operations. We have learned in attempting to make the diagnosis of a bile tract lesion to place the first and greatest importance upon a carefully obtained history of the patient and have sought as far as we could to interpret correctly this history showing the relationship between clinical symptoms and the gross pathology and I would without hesitation say that 80 per cent or more of the total value of the

evidence obtained that has helped to make a clinical diagnosis has been the accurate study of the history of the case

The second important point is the attempt to exclude by a process of elimination conditions that simulate gross lesions of the bile tracts. Occupying the position of third in order of value I should place the physical examination of the patient. Fourth the laboratory tests and fifth the X-ray findings. In regard to the latter contrary to the position taken by a number of roentgenologists we find the X-ray of little value in making a diagnosis of bile tract lesions of little value in determining the presence of gall stones. In a small percentage of cases gall stones are definitely shown in the X-ray and this positive evidence is of value but in such a large percentage of cases the gall stones cannot be determined by the X-ray and for the reason the absence of evidence is of little or no value in eliminating gall stone disease. In making a diagnosis of bile tract lesions there is another element that must be considered and it is the theory of probabilities.

To illustrate what I mean by this I would say that when a boy of 15 has an acute abdominal attack resembling in its clinical picture a gall stone attack or an acute infection of the gall bladder we are inclined to regard it more as an appendiceal lesion situated high up in the abdomen than as a lesion of the gall bladder. On the other hand when the same picture occurs in a woman of 35 who has had children on the theory of probabilities we are more apt to regard the case as gall stones or infection of the bile tracts and again in a man of 55 with the clinical picture suggestive of bile tract lesion we take into consideration also the possibility of carcinoma. We rely in gall stone cases as far as locating the position of the stones on the well known and accepted evidence that when the stones are limited to the gall bladder we have neither enlargement of the gall bladder nor jaundice with obstruction of the cystic duct enlargement of the gall bladder with obstruction of the hepatic or common ducts jaundice either intermittent or progressive determined by

the condition of the stone whether it is a floating stone or impacted. When jaundice is present we know that it is not due to a stone in the hepatic or common duct but to a stone in the gall bladder with associated cholangitis and we recognize also that when jaundice is present it may be due not only to gall stones and cholangitis but to a number of other conditions the jaundice of scirrhus the jaundice due to obstruction from carcinoma of the pancreas or carcinoma of the bile tracts themselves the jaundice of syphilis involving the liver or the bile tracts. On the whole we have learned to respect the Courvoisier law that in jaundice from gall stones in the common duct the gall bladder is contracted in 80 per cent of the cases and that in jaundice from carcinoma of the pancreas obstructing the duct the gall bladder is dilated in 80 per cent of the cases.

We have learned in the last 10 years a great deal about the relationship between bile tract lesions and lesions of the pancreas. We have had a large number of cases in which even at the time of operation it was difficult to determine the exact character of the pancreatic lesions whether they were inflammatory or carcinomatous. In a differential diagnosis between gall stone disease and carcinoma the intermittency of the jaundice or the intermittency of the appearance of bile in the urine in gall stone disease as compared with the greater persistence in carcinoma has been evident in most of our cases.

We have studied with a good deal of care those bile tract cases in which it is difficult to differentiate between a bile tract lesion and an ulcer of the duodenum or stomach. Here we have found the theory of probabilities of some service. In a man of 5 or 30 in which the differential diagnosis is clinically difficult we have found in the majority of cases that there is a duodenal ulcer and again in a woman of 40 with the same picture the theory of probabilities points to gall stone disease. We have been interested in a considerable group of cases in which we and some very well trained diagnosticians have made the clinical diagnosis of gall stone disease and advised operation and where at

the time of operation we have found no lesion of the bile tracts whatever and no lesion in the immediate neighborhood of the bile tracts such as a duodenal ulcer that might fairly account for the symptoms. In some of these cases we have exposed the appendix through the same incision and if it is diseased we have removed it with the belief that the symptoms might have been appendiceal. In our early work we drained the gall bladder in a number of cases feeling that there had been a low grade inflammation responsible for the symptoms. Of late years we have demanded very definite and positive evidence of an organic lesion before draining or removing any of these gall bladders. I shall take this matter up more in detail in discussing the surgical therapy.

As to the selection of the time for operative interference if that is decided upon we have felt that if there were no menacing condition the prognosis would be better if the patient is operated upon between attacks. On the other hand this method must not be carried too far and where the symptoms are suggestive of severe acute infection carrying with it the possibility of gangrene and rupture the case should at once receive surgical relief. In regard to choosing the time of operating on jaundice cases we have accepted the proposition where possible of operating between jaundice attacks. It is not always possible to do this but where the jaundice is prolonged and persistent it becomes necessary to interfere in spite of the greater risk that condition of cholemia carries with it both in lowered resistance and in the greater danger from hemorrhage.

After careful analysis of a case the question of deciding for or against surgical therapy must be answered. As our experience has broadened we become more radical and at the same time more conservative if I can describe our present attitude by such a paradoxical phrase. We have become more judicial and have attempted to analyze each individual case as a separate problem weighing the evidence for or against operation taking into consideration the risks of the pathological condition the risks carried by the operation for the removal of this con-

dition the general condition of the patient the age of the patient and the question as to how accurate the clinical diagnosis may or may not be. There can be no doubt as to the general advisability of removing a floating stone in the common duct that is producing intermittent attacks of jaundice. On the other hand in a woman of 70 or more with a bad heart in poor general condition with infrequent attacks the attempt at forming a judicial decision upon weighing the evidence often leads us to decide against operative interference and in favor of medical management.

As to the findings at the time of operation how closely does our clinical diagnosis agree with what is actually found in the abdominal cavity when it is opened? My internal medical colleagues have in this clinical research made a definite clinical diagnosis before operation. They have made both a pathological and an anatomical diagnosis. We have found that they have been correct in more than 80 per cent of the cases and the percentage of correct diagnoses has increased in our work since we have undertaken this joint clinical study. The internal medical man is present at the operation and he sees the exact condition that has led to the symptoms in that case. These either confirm his previous opinion or lead him to alter his views as to the relation of these gross findings and the clinical symptoms making it possible for him more accurately to estimate the clinical findings in subsequent cases.

#### SURGICAL THERAPY

Our conception of the choice of procedures for gall stone disease has changed a good deal in the last 5 or 6 years. Almost all of our operations are now either cholecystectomies or choledochotomies. With gall stones in the gall bladder or cystic duct we do now as the usual procedure an ectomy. We seldom do anotomy and limit this procedure to cases with gall bladders little diseased and without cystic duct involvement to cases which are poor surgical risks and to cases done under local anesthesia. We are more and more regarding a diseased

gall bladder containing stones in the same light as an appendix containing concretions as a structure which should be removed in order to secure a permanent cure. We have had to do so many secondary operations after cholecystotomies where stones have been left in the cystic duct that we now hesitate to leave the gall bladder where the local conditions and general condition of the patient make the removal reasonably safe. The increased frequency of removing the gall bladder has brought with it an increased frequency of injury of the hepatic and common ducts especially in the hand of the less experienced operators. The moral is to make a wide exposure and to free the cystic duct fully and actually to see the duct itself before it is clamped and ligated.

There has not been much change in our method of cholecystotomies except perhaps in the greater care with which we explore the ducts to be sure that no stone is left and to see that the passage into the duodenum is free and unobstructed. We of course make no effort to suture the incision in the duct and in titute drainage with a No. 12 catheter introduced into the hepatic duct and sutured with ten day catgut. We have learned to employ transduodenal choledochotomy wherever indicated and believe this a safer and more satisfactory operation than ordinary choledochotomy with external drainage.

In acute infections, empyema of the gall bladder without gall stones we have some times simply drained the gall bladder where the local and general conditions seemed to make the radical removal for the time being too dangerous. We prefer however where conditions warrant to do a primary cholecystectomy in these cases although undoubtedly in some the primary drainage and secondary cholecystectomy is the safest and best method. We do not recognize the necessity for surgical interference in the so called chronic and subacute infections of the gall bladder where there is no gross organic change evident in the gall bladder itself and where there is no obstruction of the cystic duct as shown by the fact that the gall bladder can be easily emptied.

We have given up draining these gall bladders as we have never seen any benefit result from draining them and we never remove these gall bladders as we do not recognize such a thing as a strawberry gall bladder which of itself demands removal. The surgeon or internist has diagnosed gall stones or an infected gall bladder and when he finds no gross evidence of either he usually removes the appendix and drains or removes the gall bladder. There is no more reason for removing such gall bladders or draining them than there is for draining or removing a kidney which is the site of a mild pyelitis with a patulous unobstructed ureter. In mild gall bladder infection with unobstructive gall duct and without pus or gall stones the process is curable quite as well by a drainage through the normal ducts as by external drainage through a rubber tube and the real fact is that most of the cases in which the gall bladder is removed or drained are cases of mistaken diagnosis and not infected gall bladder at all.

As to cholecystectomy we have practically given up this procedure in gall stone cases although one must admit that in an exceptional case it may still find a place.

Next to gall stone and acute infections carcinoma has been the most frequent cause of biliary symptoms and surgical interference warranted. Carcinoma of the pancreas and stomach with resulting jaundice has in these cases been the not infrequent finding at the exploratory operation. Here the silent course, the persistent jaundice and the distended gall bladder form the typical picture but the pictures are sometimes confusing and not infrequently the course is not silent but associated with a severe colic attack. The jaundice may be intermittent and the gall bladder may be contracted simulating clinically the typical picture of obstruction of the common duct by stone.

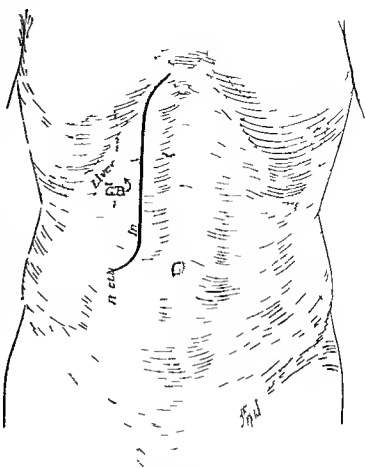
Again in this same clinical group must be placed a good many cases of chronic pancreatitis presenting symptoms which often before the operation can not be differentiated from carcinoma or gall stone disease. In fact even at the exploratory operation as a rule we have no means of telling whether a

bard firm mass in the pancreas obstructing the common duct is carcinoma or a chronic inflammatory process. We have no reliable laboratory test to make this differentiation and it is too dangerous to remove a section of the pancreas to obtain microscopic evidence of the pathology on account of the risk of hemorrhage and fat necrosis. Where obstruction of the common duct from carcinoma or chronic inflammation of the pancreas is found the indication is either a cholecystenterostomy or a cholecystostomy. The one comfortable side of this picture is that in a surprising number of cases the process is not carcinoma but inflammatory and the patient recovers permanently with the establishment of drainage. We have had 20 or more of these cases many of which we were confident at the exploratory operation were malignant but which have gone on to a permanent recovery.

Next in order of frequency is syphilis of the liver and bile tracts. As a rule in these cases we have learned to make a clinical diagnosis without the aid of an exploratory operation. Sometimes however the picture is confusing and has led to an exploratory operation. The stellate retracted scars of syphilis of the liver when found are easily recognized. Recent gummata are also as a rule characteristic. Care should be taken not to remove any tissue for diagnosis unless this can be done without danger of secondary hemorrhage. Serious and fatal hemorrhages have followed such ill advised attempts.

One of the most difficult and interesting chapters in surgery of the bile tracts is now being written and that is the plastic repair of the hepatic and especially the common duct after injury as a rule the result of operative interference. Usually the accident has occurred in a cholecystectomy. We have recently had the opportunity of studying several of these cases which are reported in the *Chicago Surgical Clinics*.<sup>1</sup>

And lastly in this resume of the surgery of the bile tracts I want to refer in a general way to the operative technique. Nothing has impressed us more in this work than the necessity of a wide and free exposure. Have



Author's S shaped incision

you ever noticed carefully when watching some master of abdominal surgery doing some difficult complicated work apparently with ease and precision and assurance and without a slip or complication in the technique that he had made a wide and free exposure that he was working to advantage because he first of all had taken the steps necessary to bring the structures involved completely and fully under his control? This is especially true of the surgery of the bile tracts.

In 1897 I introduced an S shaped incision for this work. This has proved to be more successful even than we had hoped. We have learned to use it I think more safely and to better advantage as time has gone on. I have seen it so badly employed by some men and so badly described by others in textbooks and articles that I want to refer to it briefly. When properly made the incision gives the widest exposure with but little risk of resulting hernia and it can be



readily modified to give either the small exposure needed in an exploratory operation or the wide incision necessary to expose the most complicated bile tract case or even that required to do a diaphragmatic hernia or the removal of an enormous spleen or abdominal tumor

#### S SHAPED INCISION

The incision should begin high up in the angle between the ensiform and the costal cartilage pass downward and outward parallel with the costal cartilages and about three quarter inch from them to about the middle of the rectus. It then goes down the middle of the rectus almost to the umbilicus and then curve outward for two or three inches. The skin and superficial fascia are incised in this S shaped line. The anterior sheath of the rectus is also divided in the line of the upper part of the curve and over the middle of the rectus. Unless a good deal of room is required the rectus muscle itself is not divided but simply split parallel with the fibers. If on the other hand it is necessary to make a very wide exposure the rectus muscle is divided above at the upper and lower part of the S shaped incision. At least half of the rectus muscle is left to the outer side of the incision so as not to interfere with its nerve supply.

In employing it for splenectomy on the left side the size of the S is determined by the size of the splenic tumor a huge tumor of course requiring more room than a moderate sized tumor so that in some of the large splenic tumors the incision is carried well

below the umbilicus before it is curved outward. It is important in order to obtain the full benefit of the incision to carry it well up in the angle between the ensiform and costal cartilage.

In conclusion I want to emphasize the importance of viewing such problems as we are discussing tonight as pieces of research as pieces of scientific clinical research of attacking these problems with an open mind with the assistance of our colleagues in internal medicine our associates in laboratory and X ray work. Looked upon as scientific research—studying the etiology studying the pathology found at operation attempting to establish the relationship of the clinical symptoms to the pathological picture attempting to establish a rational therapy—viewed from this standpoint of scientific clinical research this work has not been routine hospital work. It has been a great joy most interesting most instructive. The younger well trained men who are beginning their surgical work at this time when surgery has been placed on a thoroughly sound and scientific basis have before them great opportunities the opportunity of attacking with the organized trained forces of scientific clinical research the many unsolved problems that still confront us and of finding solutions which will save lives and relieve suffering. Viewed from the standpoint of scientific clinical research the modern sciences of diagnosis and therapy make the practice of medicine and surgery no longer the work that merely wins your daily bread but the most fascinating the most productive field of human effort.

## SURGERY OF THE POSTERIOR SPINAL ROOTS

WITH SUMMARIES OF RESULTS IN 244 OPERATIONS<sup>1</sup>By CARL R. STEINKE, M.D., F.A.C.S., AKRON, OHIO  
Surg. to the Ak. City H. p. 1. d. Ch. H. Hosp. 1.

**S**URGERY of the posterior spinal roots dates back 28 years when on December 31, 1888, Dr. Robert Abbe (1) of New York performed root resection at the suggestion of Dr. C. L. Dana for intractable neuralgia of the right brachial plexus. Abbe reported his case February 9, 1889, and on April 23, 1889, appeared the report of a case of persistent neuralgia operated upon by Mr. Bennett (2) of London at the suggestion of Mr. Horsley. The operation was performed 7 days prior to Dr. Abbe's, but 3 months after Dr. Dana suggested it.

Foerster (3) of Breslau in 1908 reported the operative technique for cases of spasticity and tabetic crises which bears his name. Later Foerster (4) altered his technique somewhat and used the electric current to differentiate the anterior and posterior roots while the patient was in deep narcosis. He also recommended the resection of more roots than previously.

In view of the severe traumatism occasioned by Foerster's operation Van Gehuchten (5) sought to simplify the procedure by resecting only some root fibers of each large root whose fibers connect with the lower lumb.

Wilms (2) modified this technique by transferring the field of operation to the lumbosacral region. Only a certain portion of each root is removed and unless the root consists of only one bundle at least one bundle of each root is left intact.

## RESULTS OF POSTERIOR ROOT RESECTION FOR SPASTICITY

Operations for spasticity should be done only in severe and extreme cases. Orthopedic measures such as tenotomy and plastic operations on the muscles and tendons followed by training first should be given a thorough

trial. Training must necessarily follow operation. Idiots and imbeciles should not be operated upon.

The length of time the spasticity existed before operation in the 13 collected cases ranged from 1 month to 28 years with an average of 8.6 years. This includes 9 cases of the Van Gehuchten technique and 6 of the Wilms method. There was considerable variation in the number of roots resected in the different cases: two roots were resected in 2 cases, three roots in 44, four roots in 53, five roots in 10, six roots in 7, seven roots in 1, and in 6 the number was not stated.

The areas affected by spasticity were upper extremity 4, cases lower extremity 77, upper and lower extremity 44, neck 7, and for 4 cases the areas were not mentioned.

The prognosis according to the cause of spasticity is shown in Table I.

The causes of death were as follows: operative (those within one month after operation) loss of cerebrospinal fluid 1, meningitis 5, cardiac paralysis 1, general tuberculosis 1, shock 1, acute enteritis 1, cause not stated 4, late (after one month) erysipelas and meningitis 1, meningitis 1, pulmonary tuberculosis 1, inanition 2.

## TABETIC CRISES

Prognosis as to duration of crises. There is not much difference those existing from 5 to 10 years or longer showing as great a percentage of improvement as those of 1 to 2 years duration (see Table II).

The duration of the crises before operation for the 47 cases where the time was given varied from 10 months to 25 years with an average of 6 years. Of the 55 patients where the age was given 45 were between the years of thirty and fifty, 5 in the twenties, 3 in the fifties and 2 over sixty. There were 44 males, 15 females and in 14 the sex was not stated (see Table III). The roots were resected intra-

Th. mm. d. th. p. p. w. ll. ct. dt. D. Ch. l. ll.  
P. f. Ph. d. lph. d. It. l. m. g. ly. d. ct. dt. b. m. f. th. d.  
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R. d. t. h. S. t. h. C. l. D. t. t. l. t. g. A. h. d. O. h. N. m. b. 14. 9. 6



TABLE V — PROGNOSIS OF ROOT RESECTION FOR PAIN

C			T t l	C d	Imp	Unimp	D th	
							Op	L t
N	lg	rit	8	6	8		4	3
Pres			8					5
Amp	t	p	3					
T t l			3	7		4	6	8

paralysis of the lower limbs 5 cases (2 were temporary) thrombosis of the lower limb 1 paralysis of the bladder 5 (3 were temporary) paralysis of the rectum 1 cystitis 4 pyelitis 2 pulmonary embolus 1 bulbar paralysis 1 cardiac paralysis 1 meningitis 3 pneumonia, 1 and shock 1 One patient became pregnant after operation and aborted

Operative deaths (deaths within one month after operation) were meningitis 3 pneumonia shock pulmonary embolus cardiac paralysis cystitis persistent diarrhoea hæmorrhachis 1 each Deaths later than one month were from degeneration of the posterior roots and horns 1 bulbar paralysis 1 pulmonary tuberculosis 2 and cystopyelitis 2

The results of operation for the various types of pain are given in Table V

In conclusion it was found there were 47 different operators so that no one man's technique can be accredited with the general

good results The amount of root resected varied from 3 millimeters to 3 centimeters In the spastic cases 4 were cured 50 greatly improved and 47 somewhat improved In the tabetic cases 14 were cured and 37 improved Operation for pain gave 7 cures and 9 improved out of 39 cases When one considers the gravity of the operation the mortality is not high With these facts at hand we may conclude that the operation of resection of the posterior spinal roots when properly carried out is one of great value to the patient and should be performed more frequently

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# A STUDY OF THE FRACTURES OF THE LOWER EXTREMITY OF THE HUMERUS<sup>1</sup>

BY HERMAN A H BOUMAN M D F A C S MINNEAPOLIS MINNESOTA

THE lower end of the humerus is flattened from before backward terminating below in a sloping articular surface which is subdivided by a low ridge into the trochlea and the capitellum. Projecting on either side from the shaft are the condyles. The internal condyle is large and far the more prominent; the epicondylus internus is that part of it which lies outside of the joint giving attachment for the pronator radii teres the flexors of the hand and the internal lateral ligament. Over the posterior surface runs a smooth groove to accommodate the ulnar nerve. The external condyle represents the capitellum part of the trochlea and the epicondylus externus. This body gives attachment to the supinator brevis and the extensors while unlike the other side the external lateral ligament is attached to the outer margin of the capitellum.

The capsular ligament another important structure with relation to fractures is attached in front of the humerus above the articular surface and the coronoid fossa in an inverted V shaped manner to two very faintly marked ridges which arise from the front of the internal condyle to meet above the coronoid fossa. Posteriorly the ligament is thinner but is attached in a like manner ascending from the internal condyle along the inner side of the olecranon fossa descending along the outer margin to the trochlear surface then turning outward along the posterior edge of the capitellum. The lateral bands are very strong and play an important rôle. Remembering that the surface of the joint looks forward we have also to appreciate that the muscular structures and their epa especially latertus fibrosus (of the biceps) can exert a compressive force upon the joint surface.

The normal movements of the joint are flexion and extension those of a true hinge joint yet when the forearm is flexed onto the humerus it is inclined inward the hand

reaching about the middle third of the clavicle when the forearm is extended it inclines outward forming the so called carrying angle. The limit of extension is reached when the ulna is nearly in a straight line with the humerus. When it describes an angle of 30 to 40 with the humerus the limit of flexion has been reached. The obliquity of the movements is caused by the outward inclination of the upper and back part of the trochlear surface and the greater prominence of the inner lip of the trochlea below thus the plane of motion is directed inward and forward from behind. In one of my little patients a supracondylar fracture healed in such a way that the normal obliquity and with it the carrying angle were lost while all normal movements of the joints were free and easy. The importance of the carrying angle is not to carry things such as a pail of water but to bring things to the mouth in the best possible way.

At birth the inferior extremity of the humerus is cartilaginous throughout ossifying slowly from four epiphyseal centers. Among the injuries of the elbow fractures preponderate in childhood as against dislocations in adult life this being due according to Professor Kocher to the lateness of ossification and the serial advance toward complete coalescence. At about the end of the second year there appears the first nucleus of bone in the capitellum the second nucleus appears in the epicondylus medialis during the fifth year the third during the tenth or twelfth year in the trochlea and the fourth about the thirteenth year in the epicondylus lateralis. From Parabœuf's studies we learn that the bony center of the trochlea coalesces quite early with the bones of the diaphysis while the nucleus of the capitellum joins with that of the lateral condyle. The bony center of the internal epicondyle remains isolated up to the thirteenth or sixteenth year. For a long time then there are two possible lines for

epiphyseal fractures one between the trochlear shaft bone and the capitellum and external condyle combination the other between the internal epicondylar body mesially and the trochlear shaft bone laterally. These lines are readily rediscovered in practice. It is therefore anatomically explained why fractures through the condyles (Kocher's fracture diachondylia) have not been seen after the fourth year while fractures along the lines mentioned above occur as late as the sixteenth year.

It seems profitable to divide the fractures into two classes (1) the most frequent and (2) the least frequent.

1. *The most frequent* comprise the supracondylar fractures and the fracture of the external condyle.

A supracondylar fracture means a transverse separation of the lower end of the diaphysis close above the condyles. Kocher has artificially effected this fracture by holding the lower end of the humerus in a vise and forcibly extending or flexing the forearm. By holding the end of the forearm on a board the elbow flexed at a right angle and then dropping a heavy weight upon the back of the lower humerus a supracondylar fracture was produced. Fixing the condyles in a vise and flexing the diaphysis forward or fixing the lower humerus and rotating outward results in supracondylar fracture.

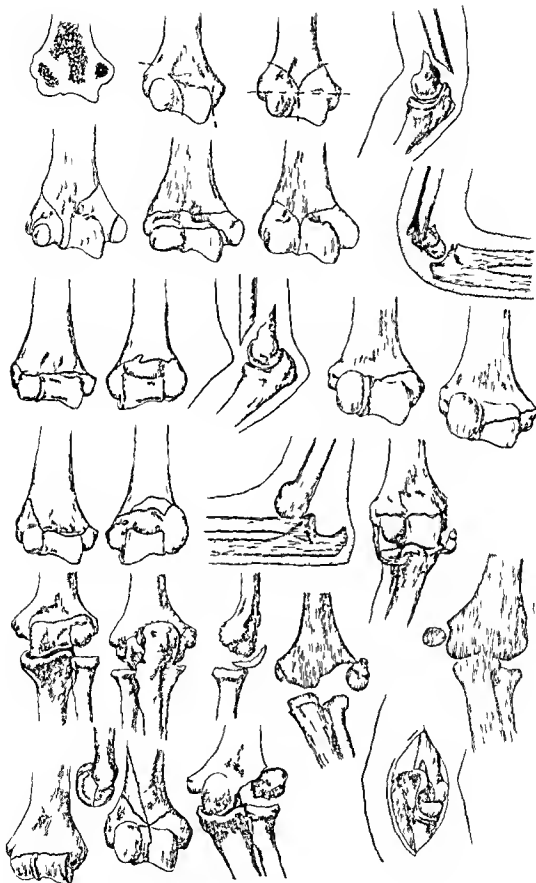
The line of separation gives two clinically distinct pictures depending entirely upon whether the pinch is placed posteriorly or anteriorly. A stick of sound wood cannot be broken perfectly square by holding it over a hard edge. The line of fracture runs away from the point of pinch. In the extension fracture the pinch is from the capsular ligament insertion in front and lateral ligaments in which case the line of fracture runs from there up (anterior low posterior high). The upper fragment slides down over the lower one and the clinical picture of a posterior dislocation of the elbow is deceptively real. One of the writer's patients held his hand against a post of a gate and an animal ran against his arm from behind so that he sustained a supracondylar fracture. However that is not the usual way of procedure as a rule they result

from a fall on the hand of a half extended forearm and the stress is on the capsular ligaments and muscular attachments.

With the fracture by flexion the pinch is behind. In this case also the line runs up but not posteriorly low and anteriorly high. The upper fragment slides down over the lower part but not so far as to liken luxation since the taut drawn triceps limits this movement. These fractures come about by falling on the flexed elbow. The sharp fragments may easily cause complications by cutting skin and muscles inducing infection. Even vessels and nerves have been cut.

The fracture of the external condyle is second in frequency. It means a separation along the epiphyseal line of the shaft from a part of the trochlea the capitellum and the epicondylus externus. This has been artificially effected (Kocher) by compressing the humerus fixed in a vise so that it appeared as if the external condyle had less resistance than the inner condyle. Another means of procedure was to force the radius against the capitellum with the elbow in flexion. Clinically this fracture results from a fall on the hand of the bent and pronated arm or a fall on the outstretched hand the force being received and transmitted by the radius. From a fall on the elbow the arm being in abduction this fracture obtains if the capsule breaks at its mesial insertion so that the turning out of the olecranon forces the external condyle to give way.

The fracture of the inner epicondyle is the pulling or tearing off of the prominent bony process of the inner condyle by the strong internal ligament inserted at its base if the bone holds the ligament parts and a posterior dislocation of the forearm presents. A very small laceration of the capsular ligament over the trochlea suffices to make the dislocation possible. It may be replaced spontaneously or even may be made or unmade at will. The writer saw Professor Kocher demonstrate such a case. It is clear then why this fracture occurs with luxation or may be a stepping stone to it. This injury may take place in several ways (1) falling on the hand of the abducted outstretched and hyperextended arm or (2) upon the elbow the forearm bent



Typ l t m of the fact s f th l t mty f th h me (Th ill t t t l  
 fom l b ok p p lly f m k h d d Q )

and the humerus abducted will indirectly effect this fracture by stress on the lateral ligament and muscular structures (3) it may result from falling backward with the hand held behind the back so that the whole weight is brought to bear upon the prominent epicondyle. We are cautioned (Kocher) to look for this fracture also in combination with more severe and extensive injuries such as the

Y and T types

*The least frequent fractures* The fracture of the inner condyle is a separation of the shaft from the inner condyle. Anteriorly the line runs through a part of the capitellum and posteriorly through the trochlea. When falling upon the adducted arm the olecranon pinches the condyle out of position, the instinctive thrust of defense usually puts the arm away from the body and that may be the reason why this fracture has not been observed often. As in other large joints there are two intracapsular fractures of the elbow: (1) the one goes through the condyles below the epicondyles (Kocher's *fractura diachondylca*) (2) the other is a partial fracture of the capitellum.

In the former the whole surface of the joint with its cartilaginous covering is moved off of the humerus in the latter the capitellum is barked and the peeling of bone and cartilage is displaced usually forward within the joint cavity. These injuries could not occur without a lack of bony resistance as an etiological foundation. The *fractura diachondylca* has been observed only in young children from two to five years of age and the injury of the rotula seems to occur in individuals who have some bony changes. One is instinctively reminded of the knee joint where the loose bodies may lock it.

When extraordinary forces bring about injuries at the elbow the greater or lesser resisting capacity of the bone ceases to be a recognizable directing factor for the line of separation. Compound and complicated fractures result among them two principal types are recognized the Y and T forms. The former is the separation of the condyles from each other and from the shaft the latter means a supracondylar fracture with an added separation of the condyles from each other.

With these facts in mind it is evident that a clear cut diagnosis may be a safe director of a successful management. Valuable as are the roentgen rays they are not indifferent in their effect on growing bone and therefore the time of exposure should be brief and as infrequent as practicable. Both elbows should be x-rayed as the control is of much use. Owing to the many cartilaginous lines it is well to be guarded. For greater efficiency and for better judgment the older methods of examination should also be employed.

Unless the injury has been brought about by extraordinary force it is in early youth that these fractures usually occur. The true intracapsular fracture (*diachondylca*) has not been seen later than the fourth year. After the period of growth only a few supracondylar fractures have been reported.

Excellent clues should be found in the manner in which the patient met with his accident. The bones being thin in children and the swelling often extensive accurate palpations are exceedingly difficult and a good history is therefore much appreciated. Man's upright walk is required to maintain this position the center of gravity lies forward thus a child falls very often forward falling with instinctive defensive action of the arms is far more frequent than backward or sidewise falling. If injury is sustained its form is in relation to the most frequent manner of falling thus the fracture most common is the supracondylar produced by falling forward upon the hand which brings the whole weight to bear upon the lower humerus where the capsular ligament during overextension directs the line of fracture. If the falling forward occurred upon the bent elbow the lower humerus again must take the full blow the line of fracture being given by the capsular ligament being forced into overflexion. Falling upon the half bent elbow of the abducted arm is also common in which case either the olecranon directly or the radius by the palm of the hand indirectly brings the blow to bear upon the external condyle. That the arm should not have time for defense is unusual so that a sudden fall upon the adducted arm striking the prominent part the olecranon or the internal condyle and causing fractures is





F C R O N T	F Q U E N T			I N Q U E R Y			L i n e
	F t S p i	F t S p d	F t C d h	F t E p i	F t E p d	F t C d i	
M t m E t	M t h	N m a l	N m a l	N m a l	N m a l	N m a l	I m p a s b l
F l	T r i g h t g l	N m a l	N m a l	N m a l	N m a l	N m a l	O l y t r i g h t
S p a n t	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l
P t	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l
A b r m l A b d t	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N
A d d e t	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N
A t p o t n m b l t y	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N
P t P h p	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	A b t
T t f f m	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N f e e t
I t m l p d h l d h l	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l
E t l e p d h l d h l	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l
O l e c	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	N m a l
R l t f t h d t	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	O l e c
R d h d	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	E t s u i m p o s b l
R l t i d d	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	E t s u i m p o s b l
P r e s e n t b y p m e s	M t m E t h	N m a l	N m a l	N m a l	N m a l	N m a l	E t s u i m p o s b l

unusual. If a young child falls upon its fully outstretched hands the muscular structures and the capsular ligament exert such a compressive force that the whole articular cartilage with an adherent bony shell may peel off producing a true intracapsular fracture.

With an accurate history we turn to inspection restraining the almost irresistible impulse to grab the victim. Usually when serious injuries are sustained with his good hand the patient carefully supports his elbow in light flexion. In supracondylar fractures the arm will rarely hang down helplessly. More definite clues are given by the relations to each other assumed by the axes of the fore arm and the humerus. The carrying angle is lost or even reversed as the capsular ligament gives way in the fractures of the external condyle and of the internal epicondyle, the internal condyle and the external epicondyle. This fact can be seen readily as with such fractures the arm is in partial extension. Often the same condition exists with the supracondylar fractures only it is not so evident as the limb is held in flexion.

The swelling is usually commensurate with the extent of the fracture. The whole elbow is involved in the severe form the Y, T and supracondylar a part one or the other side with the uncomplicated fracture of the condyle or epicondyle. There is often very little swelling with the fracture of the rotula or the intracapsular fractures. There may be a broken skin or severing of soft parts in the supracondylar fracture by flexion and these complications may be expected when extraordinary force causes the damage such as falling from great heights or machine power. In such cases the wrist may drop there may be lack of sensation in the ulnar region or even vascular disturbances may occur. Ecchymosis is usually present and may point to the nature of the injury by its presence in one particular side or spot or involving the whole joint. Abnormal bony prominences may be seen. In the supracondylar fracture by extension the olecranon is pushed out backward giving the swollen elbow a concavity behind and a convexity in front.

While the external condyle is overprominent

in supracondylar fractures it is almost gone when it has been broken. Normal bony prominences may be missing and depressions noted as in the fracture of the external condyle and the internal epicondyle. With this latter injury dislocation is often present. When the rotula is broken there is usually an abnormally large olecranon owing to the displacement of the loose shell within the joint near the olecranon.

Conclusive evidence is given by actual manipulation. Active motion is helpful only in a general way. A patient with a dislocation or an extensive fracture will not move his elbow much while a partial fracture will not greatly hinder him. The effect of a nerve injury cannot escape observation. A valuable sign is the push pain. With the humerus grasped gently and firmly above the elbow the hand or forearm is given a quick push. The sudden contact of one broken surface with the other elicits a sharp pain. In supracondylar fractures it is difficult to miss but when the external or internal condyle is broken the forearm is abducted or adducted so that the push will reach the part. Full normal function in one direction only and not in the other usually means dislocation.

Supracondylar fractures the fracture of the internal condyle and the partial dislocation allow overextension as the capsular ligament is torn in the latter and loose in the former. Free extension is also to be expected in all other forms of fracture except where a loose body interferes as in the intracapsular fracture or in the Y and T fractures when some of the fragments are loose in the joint.

Flexion is free except for the swelling of soft parts and hemarthrosis in all partial fractures such as those of one or the other condyle or epicondyle. Flexion is rigidly stopped at a right angle in posterior dislocations it is only partial in the supracondylar or Y and T fractures. Rotation of the forearm is usually unhindered. Supinations may be too free with the fracture of the external condyle.

Side-wise mobility abduction and adduction though slightly present in young arms is abnormal and gives most valuable evidence. This could not obtain if the capsular ligament

were intact or the bony parts of attachment rigid. In dislocations there are neither lateral nor anteroposterior movements. When the shaft of the humerus is grasped in one hand and the condyle in the other and there is mobility and crepitation on abduction and adduction a fracture above the condyle is present if there is mobility in adduction only; there must be a giving away of the external lateral ligament which occurs in the fractures of the external condyle. Abduction is too free when the internal condyle is broken off which is usually accompanied by extensive tears of the ligament. In addition it is possible to elicit crepitation by moving the one or the other condyle or epicondyle against the shaft. Movement of the condyles against each other and both against the shaft in all directions may make it feel like a bag of marbles. Such findings prove a complicated fracture like the 'Y' and 'T' forms.

The exclusion of abnormal mobility does not preclude fracture. The elbow has normal landmarks. In flexion the olecranon and the condyles form a triangular frontal plane; in extension they form a line. These known points may be disarranged in their relation to one another; one may be more prominent or may have disappeared or there may be seen new prominences. In the presence of dislocation the olecranon sticks out backward and the triangular plane becomes a concavity; in extension the olecranon stands above the horizontal line. The normal relation is preserved in the supracondylar fracture but there will appear anteriorly or posteriorly as the case may be the sharp prominence of the fracture. Where normally the external condyle should be there is a depression in which a rough and irregular body moves with the pushed up head of the radius which could only be the torn off external condyle drawn down by the external lateral ligament. Only the external epicondyle may be missing. There may be absence of the prominent internal epicondyle with dislocation. Palpation of the internal condyle too far away from the olecranon and a sharp edge close to it on the humerus prove a diagnosis of the

broken internal condyle. Relation and distance of the landmarks may be correct only the olecranon feels broadened, the reason being that a loose body lies near the olecranon within the joint such as the articular surface of the condyles or that of the capitellum. On the other hand there may be no relation at all with injury to the soft parts as in the complicated 'Y' and 'T' fractures.

One other diagnostic measure is important. Simple traction of the forearm will straighten a fracture but a dislocation remains unchanged. It seems clear that when a painstaking diagnosis has been made a practical means of correction may be found to fit the case. It is thus that the plaster cast has at times been a success in one or the other position. To us it seems that it should not have a prominent place. The bones in children are thin and soft parts are well upholstered with fat so that the tendency to displacement and disaster is great and indeed frequent. What means other than surgical will serve to replace a turned about external condyle or a displaced cap of the rotula? These parts must be removed and the capsule repaired or a stiff elbow will result either from the interference of the broken parts or the growing callus. Whenever mechanical means are feasible some means of weight extension should be the method of preference, the forearm being in supination and at a right angle to the humerus. In this position all the muscles are equally stretched, the circulation is unhindered and the humerus is kept straight. The 'Y' and 'T' fractures are usually surgical though waiting may be necessary because of the condition of the soft parts. Loose fragments must be taken from the cavity of the joint. To prevent excessive callus the external condyle may be removed and a tolerable joint is expected.

It is not the purpose of this study to enter into the difficult problem of successful treatment. Obviously the correction of a fracture depends upon a proper diagnosis and in our opinion fractures of the elbow should be approached with the same concern as are conditions of the abdomen or the chest.

## MESENTERIC VASCULAR OCCLUSION

By ARTHUR A. EISENBERG, A.B., M.D., CLEVELAND

Resident Physician, St. Charles Hospital, Cleveland, Ohio; Assistant Surgeon, St. John's Hospital, Cincinnati; Pathology School, Medical University of Ohio

AND

HENRY A. SCHLINK, A.B., M.D., CLEVELAND

Resident Surgeon, St. Charles Hospital, Cleveland, Ohio

OUR attention was directed to the extremely interesting surgical condition mesenteric vascular occlusion through a rather unusual opportunity to study within a short space of time—two months—four cases of mesenteric embolism, the entire series making up a very instructive picture of the same condition being brought about by three different causes: acute infection, chronic infection, and injury. Of especial interest is the fact that in these cases we had an opportunity to study the differences in symptomatology and pathological anatomy as related to the duration of the disease.

We purposely substituted the term mesenteric vascular occlusion as used by Trotter (1) for the various other names used in describing the several varieties of this condition: viz. mesenteric embolism, mesenteric thrombosis, mesenteric arterial embolism, mesenteric venous thrombosis, etc. It seems to us they are useless clinically since a definite symptomatological picture which would enable one to make a diagnosis of arterial occlusion rather than the venous does not exist. Even the terms thrombosis and embolism are of no value clinically since the most frequent source of thrombosis is an embolus. For these reasons we felt that unless one discussed the subject from the standpoint of pathological anatomy the term mesenteric vascular occlusion would probably be preferable.

The condition while not an extremely rare one is nevertheless one of sufficient rarity to be interesting, thus from the time the first case of Tiedeman was reported in 1843 until 1913 there were collected 366 cases (1). Since Trotter's monograph has appeared about 35 to 40 more cases have been reported thus bringing the total to about 400 cases.

CASE 1. Male, age 48, machinist, entered the

Charity Hospital May 10, 1917, giving a history of having had a piece of steel in the index finger of the left hand two months previously. From that time his finger remained sore and about two weeks prior to the patient's admission to the hospital the entire left hand became swollen and painful. It gradually grew worse, an ascending lymphangitis and lymphadenitis developed. An attempt to establish a good drainage by means of an incision under local anesthesia was unsuccessful the day before the admission the left ankle became painful and swollen.

The examination upon the admission revealed a well built man with temperature of 91° and pulse of 20. The affected hand is about twice the normal size with marked lymphangitis up the entire arm and greatly enlarged axillary gland. The ankle is swollen and red, the patient complains severely of the pain in the hand.

Operation May 10, 1917 by Dr. C. A. Hamann. Ether anesthesia. Several incisions were made on both palmar and dorsal surfaces of hand. Much pus was obtained. Tube drainage. An incision of the foot revealed no pus. May 13, evening temperature 101°, pulse 108, hand draining freely, patient delirious. May 19, the foot was much more swollen. It was incised under ether anesthesia, hand draining freely. Dakin's solution applied. June 15, hand and foot improving, not much purulent discharge, evening temperature 99°. June 7, temperature rose to 103°, both hand and foot painful. Roentgenogram of the hand and wrist shows much destruction of the metacarpal and carpal bone, also involving the lower ends of the radius and ulna. June 30, both the hand and foot freely incised, some pus obtained, marked destruction of tendons of the hand. July, hand and foot looking better, less swelling, temperature is still about 101°. July 6, temperature subnormal, hand and foot progressing favorably. July 9, 12 o'clock, patient suddenly seized with severe cramp-like pain in the abdomen, markedly dyspnoeic. He soon became very pale and covered with cold perspiration. There was some abdominal distention and generalized tenderness. Defecation could be felt, no vomiting, no diarrhoea, pulse almost imperceptible. Death at 3 p.m., i.e. three hours after the onset.

Diagnosis of mesenteric embolism was made being based on (1) source of embolism, (2) rapid and marked fall of temperature, (3) very severe colic-like abdominal pain, (4) abdominal distention and generalized tenderness, and (5) suddenness and short duration of attack.

The autopsy (A A E) showed no free fluid in the peritoneal cavity the omentum was slightly congested the mesentery was purplish mottled with thick veins and dark areas the small intestine was congested but not extremely so nor in its entirety only the lower part of the jejunum and approximately one half (the upper) of the ileum was congested the congested mesentery corresponded to the part of the intestine involved there was absolutely no gangrene present the superior mesenteric artery contained a firm adherent embolus the size of a large shot within one half inch from the aorta a large thrombus was found in the left ventricle of the heart firmly adherent to the left posterior wall. Close inspection of the aorta revealed a small patch about one half square inch near the opening of the latter which showed that form of atheroma which is referred to in German literature as *gitterförmig* (lattice work) however even though the local changes in the artery wall may have played a predisposing part this case was we feel certain one of embolism rather than of thrombosis because of the suddenness and the rapid progress of the case we shall dwell more fully upon this point in the subsequent discussion of the differential diagnosis of the two conditions

CASE 2 (Dr A Peskind) A complete history could not be obtained for some reason but the important points in the case are these the patient male about 70 years old had suffered for a number of years with endocarditis about two months prior to his death he was taken ill with persistent diarrhoea and some vague abdominal pain he ran a septic fever the laboratory examinations performed by one of us (A A E) were as follows nothing of importance was found in either the urine or the faeces the blood examination showed a pronounced leucocytosis blood cultures showed streptococcus viridans he did not show much change during the next five or six weeks but gradually became better his temperature became almost normal when suddenly one night he was seized with violent abdominal pain he became cyanosed showing all signs of collapse and died within six or seven hours after the onset The diagnosis of mesenteric embolus was made by Dr A Peskind The autopsy (by A A E) showed a large number of old vegetations over the mitral and to a lesser degree aortic valve — one vegetation being as large as a large pea the omentum and mesenteries were greatly injected and discolored the small intestine was also congested and discolored for the distance of two or three feet but there was no gangrene present The superior mesenteric artery was plugged from the point of its origin to a point about 15 centimeters into its lumen by a thrombus which was quite adherent to the walls of the artery

CASE 3 (Dr N T B Nobles) J G male 17 fell down while trying to step over a box striking his abdomen on a cement floor he had a big watch in a pocket which was in a usual place — over the right iliac region The watch was broken completely

by the fall — the crystal as well as the mechanism but no incised wound was inflicted

The boy complained of some soreness but kept at work During the succeeding five days the soreness — it could hardly be then called pain — gradually disappeared On the sixth day the patient complained of a moderately severe abdominal pain but there was no vomiting and the bowels moved regularly however the pain was severe enough to keep him in bed During the next two days his condition was about the same but on the following morning after a light breakfast he complained of a sudden very severe general abdominal pain and vomited some greenish material the family physician was called in and upon examination found the boy in agonizing pain not localized over any part of the abdomen a little distention pulse almost imperceptible the face and the body covered with cold perspiration and other signs of collapse Diagnosis of intussusception was made The operation performed the same evening about 9 p.m. showed a large quantity of free blood in the peritoneal cavity the peritoneum was markedly injected the intestinal loops were matted together practically the entire small intestine and its mesentery were gangrenous and collapsed showing at once that a case was not one of intussusception but one of mesenteric vascular occlusion About 8 feet of gangrenous intestine were resected and an end to end anastomosis was done The patient died within half an hour after the operation No autopsy was permitted

#### DISCUSSION

We mentioned elsewhere that the condition is not an extremely rare one yet according to Trotter out of 366 cases collected by him only in 13 was a correct diagnosis made *intra vitam* or in about 4 per cent of cases This then must be due to the fact that the mesenteric occlusion is not thought of when considering the differential diagnosis of an acute abdominal condition We will discuss the general features of our cases together with the general consideration of the subject but we wish to call attention to several interesting features of these cases

The first is the relation of the duration of the disease to the pathological changes only

Case 1 with the shortest duration showed congestion of both the intestine and the mesentery but no gangrene, Case 2 with duration of 6 to 7 hours showed necrosis of a larger part of omentum and mesentery but hardly the beginning of gangrene of the intestine while Case 3 with the longest duration of all showed extensive gangrene Case

4 showed complete gangrene of the entire intestinal tract

It seems then that surgical intervention if it is to be successful must be sought as early as possible within the first few hours. The other interesting point brought out by the study of these cases is the extreme importance of the history of the case in considering the diagnosis. Thus in both cases where the correct diagnosis was made (Cases 1 and 2) the fact that in both cases a source of embolus was readily conceived (Case 1 — acute pyogenic infection Case 2 — chronic endocarditis with a concomitant streptococcus viridans infection) was of the greatest assistance in arriving at the correct diagnosis.

In the four cases studied we have two cases due to embolus with pyogenic infection as its ready source while the other two cases were so far as we can judge due to injury (Cases 3 and 4) in comparing the two sets one is struck with the fact that both infective cases lasted but a short time since a sudden throwing of an embolus rapidly occluded the circulation while the two injury cases lasted a number of days and showed a marked gangrene formation probably because these cases had a local thrombosis as their cause (due to injury) which developed much more gradually. Another striking feature is the fact that Case 4 had normal pulse and temperature and had not vomited.

#### PATHOGENESIS OF MESENTERIC VASCULAR OCCLUSION

1 Mesenteric venous occlusion occurs in about 40 per cent of all cases of mesenteric occlusion. In the majority of cases both the superior and inferior vein are simultaneously involved. Involvement of the inferior vein alone is extremely rare because it forms richer anastomosis with the systemic venous system relatively to the amount of blood to be carried away than does the superior mesenteric vein and thus makes possible a more efficient collateral circulation.

In general venous occlusion is much less dangerous than the arterial for the reason that the venous intestinal circulation can be

carried though a large part of the mesenteric venous system had been thrombosed — so long as tributaries which are free from clot open into the main trunk above the highest limit of the clot and the anastomosing arcades and their radicles leading from the intestine remain patent (Trotter). Even if the latter are occluded the infarct is frequently limited to the segment corresponding merely with the occluding radicles. In fact the superior mesenteric vein has been tied near its termination in two cases — (2 and 3). Several cases are recorded in which even the portal vein was ligatured or thrombosed and the patients either recovered or survived a considerable time — (4 5 6 and 7).

The common causes of venous mesenteric occlusion are descending portal thrombosis (usually due to sepsis or pressure due to cicatricial contraction of liver as in syphilis, cirrhosis, malignant growth etc.) more rarely (30 per cent of cases) a primary condition due to phlebitis resulting from an infectious process in the intestine (most often appendicitis — 75 per cent of all cases of primary thrombosis) according to Polya (8).

Mesenteric arterial occlusions occur in about 60 per cent of all cases of mesenteric occlusions and of this in an overwhelming number of cases it is the superior mesenteric artery that is occluded. When this happens the damage done to the intestine depends of course on the seat of embolus if the trunk of the vessel is occluded close to its origin from the aorta then the entire small intestine (with the exception of the middle and upper horizontal portion of the duodenum) and in addition the cæcum the ascending and the transverse colon are involved.

We are now confronted with an extremely interesting question why is there formed following the mesenteric arterial occlusion a hæmorrhagic infarct? In the light of Cohnheim's well known theory of the genesis of hæmorrhagic infarct it seems impossible that this should happen in the intestine since the superior mesenteric artery is not an end or terminal artery. As Nothnagel (9) points out the colica sinistra artery originating from the inferior mesenteric artery forms the largest anastomosis in the body

with the coeliac media artery which originates from the superior mesenteric artery and communicates with the coeliac axis through the gastroduodenal branch of the hepatic artery all the branches of the superior mesenteric artery can be injected with wax from the aorta through their numerous anastomoses even after the ligation of the main trunk of the artery.

Nevertheless Litten's experiments (10) showed that the mesenteric arteries while not terminal anatomically are so physiologically probably as pointed out by Taravellier (11) because the pressure in these arteries is about 80 millimeters mercury while it takes that of almost 300 millimeters mercury to force the blood through the entire intestinal supply besides the anastomosing arcades are present only in the middle of the territory supplied by the superior mesenteric artery.

The reason the superior mesenteric artery is occluded so much more frequently than the inferior is as follows:

- 1 The superior mesenteric artery arises from the aorta above the inferior and has therefore an earlier opportunity of intercepting an embolus.

- 2 The superior mesenteric artery measures 9 millimeters in diameter while the inferior measures only 3.5 to 5 millimeters.

- 3 The superior mesenteric runs a course nearly parallel to that of the aorta while the inferior leaves the aorta at an angle of about 45 degrees.

Inasmuch as the most frequent cause of thrombosis is an embolus the autochthonous thrombosis of the mesenteric arteries being extremely rare it suffices to consider the sources of the embolus to close the consideration of the pathogenesis of mesenteric vascular occlusion. Acute and chronic endocarditis affecting the mitral and aortic valves are by far the most common the two sources next in frequency being the atheroma of the aorta and pulmonary emboli — very rare.

Finally 22 cases have been collected where both arteries and veins were occluded (11, 12 and 13).

#### PATHOLOGICAL ANATOMY

Under pathological anatomy the changes in the mesentery and the intestines are to be

considered. As has been mentioned the extent of changes depends solely on the amount of the damage to the circulation.

In the mesentery the most striking change is edema which may advance to an extreme degree producing enormous thickening. Edema may be localized or diffuse in the case of the former one may confuse it with mesenteric adenitis usually however it is diffuse and the first effect of it is the diminished motility of the mesentery — a factor which may *per se* contribute largely in the production of intestinal obstruction.

Blood extravasations are frequently found in the vicinity of the occluded vessels varying in size from petechiae and small ecchymoses to large hematmata palpable through the abdominal wall.

It has been claimed that these hemorrhages are due to a collateral arterial supply but as pointed out by Taravellier (11) were this true these hemorrhages would be most marked at the boundaries of the affected areas whereas in reality they are most pronounced about the obstructed vessels where the compensation is least. With the advance of the occlusion gangrene and necrosis supervene.

The intestinal lesions caused by the occlusion of mesenteric vessels are of two main types (a) hemorrhagic infarction and (b) ischemic infarction.

Of the two lesions the hemorrhagic infarction constitutes the vast majority of cases. It may be brought about by closure of the arteries the veins or both. As Gallavardin (14) points out the venous congestion is by far the most important cause.

The extent of the infarct varies of course from a few necrotic patches to the involvement of the whole small and large intestine.

The condition of the infarcted loop is practically the same as that in a strangulated hernia since the condition of the vessels is the same the coil loop is dark red purple or blue black usually is very much thickened because of the filtration of its walls with blood and serum and is distended from accumulation of gas in the interior. The mobility of the coil is usually seriously impaired or absent.



Microscopically the first changes to be noticed are œdema and leucocytic infiltration as well as discrete capillary hæmorrhages. The tissues are much thickened because of the inflammatory infiltration.

The next stage is that of engorgement — the capillaries and the vessels are enormously distended.

Now comes the stage of hæmorrhagic infarction proper — extravasation of blood into the intestinal coats especially pronounced in the submucosa where it may be so extensive as to separate the mucosa from the muscularis (15). The mucosa shows the most marked necrotic changes the villi are either completely degenerated or entirely absent. Lieberkuhn's glands are distended and partly necrotic. The muscularis shows fewer changes than any other coat.

The thrombotic infarction still presents one of the most interesting problems of pathological physiology since nothing but contradictions exist as to its causation. Spengel (16) claims that it is due to simultaneous obstruction of both the arteries and the veins yet this is at variance with actual facts since out of cases of double vascular lesions only three showed ischæmic infarction.

The explanation of Iedowitsch (13) is that it is due to obstructed arterial supply combined with unobstructed venous circulation.

The intestinal wall at the site of the ischæmic infarct is white or grayish, bloodless and very thin.

#### SYMPTOMATOLOGY

Because of the various forms in which the disease appears it is impossible to outline a definite course but there are a few outstanding symptoms which if properly interpreted may lead to a correct diagnosis. One feature must again be emphasized viz that the symptoms are the same whether they are due to the arterial or venous occlusion.

**Age** The youngest case reported was that of a child of five. The oldest was a woman of 85. But the majority of cases occur between 20 and 60 years of age. Lagane (19) mentions a child one month old.

**Pain** The onset of the disease is usually

sudden and begins in most cases with severe colic or cramp like pain in the abdomen lasting for five or ten minutes at a time and passing off for an equal time or it may be continuous. In Case 1 it was continuous throughout the three hours of the attack and was unaffected by morphine. In every one of our cases pain was the earliest symptom. In the majority of cases reported it is generalized throughout the abdomen being usually more intense about the umbilicus or in the epigastrium. The point of maximum intensity may be situated in either hypochondrium or in the lower abdomen. At the present time the origin of the pain is explained as being due to traction on the mesentery and parietal peritoneum from excessive peristalsis, the infarcted coil acting as a source of such peristalsis to the rest of the bowel. If the attack lasts long enough swelling of the mesentery may also cause traction.

**Tenderness** Associated with the pain there is usually extreme tenderness throughout the whole abdomen.

**Abdominal distention** Abdominal distention is a constant sign which generally appears very early and increases as the disease advances. It is usually quite general but may be localized. The percussion note is tympanitic except over an occasional area where the intestinal coils may become thickened by œdema and blood extravasation and occasionally in the flanks where the dullness is due to free fluid. Visible peristalsis is extremely rare.

**Tumor** Satisfactory palpation of the abdomen is generally rendered difficult by the distention and tenderness both of which may be extreme also by the reflex muscular rigidity. Consequently in only a few cases has a definite tumor been felt. In some cases a localized resistance can be felt.

**Gastrointestinal symptoms** The gastrointestinal disturbances may be divided into two groups viz (1) those due to irritation in which diarrhoea and mæna preponderated and (2) those resembling the symptoms and signs of acute intestinal obstruction. Usually when diarrhoea is present the stools are very thin and watery and if blood is present are very offensive. The stools may be only blood

stained or may consist of almost pure blood which may be bright red or tarry in nature (17)

Defecation is frequently painful and associated with tenesmus. Constipation may be partial or complete depending on the amount of damage done to the affected coil by the circulatory disturbance and by the subsequent peritonitis. Borszely (18) regards neither diarrhoea nor constipation as a constant symptom but attaches importance to the succession of constipation upon diarrhoea. Constipation from the onset of symptoms is rare. Vomiting usually comes on quite early and may persist until death — yet our Cases 1 and 3 did not vomit. At first vomitus consists of gastric contents later may contain blood which may be either bright red, dark brown or black, coffee ground in type. The last named type should not be mistaken for fecal vomiting. No case of fecal vomiting is on record (2).

*Pulse temperature and respiration.* In the early stages in most cases the temperature is subnormal but later may rise to  $104^{\circ}$  or  $105^{\circ}$ . Later in the attack when collapse supervenes the temperature again becomes subnormal. The pulse rate is generally that of a severe internal hæmorrhage, small, rapid and in many cases irregular as shown very well in Case 1. The respirations soon become accelerated thoracic in type. The patient's appearance becomes a combination of pallor and cyanosis, the pallor being due to shock and the cyanosis to diminished respiration.

#### DIAGNOSIS

The two chief factors responsible for the failure in the diagnosis of occlusion in the mesenteric vessels have been first the disease has been considered so uncommon that it is not considered in the diagnosis of acute abdominal conditions and second the extreme variation in the clinical picture. The signs and symptoms produced by occlusion of the arteries so closely resemble those due to the venous occlusion that it generally becomes impossible to differentiate clinically between the two conditions. However as a rule embolism is more easily diagnosed than any other type of lesion. The signs and

symptoms considered of greatest importance in the diagnosis are

- 1 Very severe colic like abdominal pain
- 2 Distention of abdomen with tenderness tympanitis and occasionally shifting dullness
- 3 Rapid and excessive fall of temperature associated with a weak and rapid pulse
- 4 Copious melenæ with diarrhoea followed by constipation
- 5 Persistent vomiting
- 6 Palpable tumor due to formation of large hæmatomata between the layers of the mesentery
- 7 Appearance of patient manifesting grave constitutional disturbances
- 8 Source for the embolus e.g. endocarditis
- 9 Age of patient — usually over 20 years

#### DIFFERENTIAL DIAGNOSIS

*Intussusception* may readily be confused with infarction of the intestine. But intussusception is a disease usually occurring in childhood with a history of previous attacks and complete abatement of symptoms in the interim. On bimanual abdominal and rectal examination a sausage shaped mass may often be felt. In infarction the amount of blood and fecal matter should far exceed that passed in intussusception which is blood stained mucus.

*Volvulus.* Though the signs and symptoms of the two diseases may be the same absolute constipation associated with early extreme distention would favor the diagnosis of volvulus for as stated previously absolute constipation is rare in the early stages of infarction and although the distention may come on early it does not become so extreme.

*Pathological complications* which may follow an attack of acute appendicitis and give rise to acute intestinal obstruction are almost impossible to differentiate from infarction. The obstruction in those cases is due to toxæmia, peritonitis, adhesions or infarction of the intestine from thrombosis of the mesenteric veins. The first two complications come on so soon as to be almost a part of the original disease whereas the latter two may appear after an interval of variable duration. The symptoms following obstruction due to link

ing of the intestine from adhesion are usually not nearly as severe and grave as in infarction.

*Acute pancreatitis of the fulminating variety* (Deaver) is extremely difficult to differentiate. In this disease the temperature may be subnormal, pain and shock severe and vomiting persistent. Intestines become distended and paralytic, causing almost complete obstruction. Absence of blood in stools, provided constipation is not absolute, is in favor of acute pancreatitis.

*Typhoid fever* with perforation particularly of ambulatory form needs to be considered in the differential diagnosis.

### TREATMENT

A few cases in which a diagnosis of mesenteric thrombosis was made have recovered under the expectant treatment but in those cases the diagnosis obviously may be questioned. At best the treatment has been unsatisfactory but the prevalent opinion among most observers appears to be that the sooner operative measures are undertaken the better the prognosis is shown by the absence of gangrene in our first two cases which had lasted not over 5 or 6 hours. In those cases in which all or most of the intestines are gangrenous it is obvious nothing surgically can be done. In this connection Zesas quotes experiments on animals and concludes that in man at least two thirds of the intestine must be left behind in order to obviate the possibility of death from inanition. If however only a small segment of intestine is involved any method of resection and subsequent anastomosis which can be done most rapidly affords the patient the best chances of recovery. In more extensive destruction of intestine and peritonitis drainage must be used.

### CONCLUSIONS

1. Mesenteric vascular occlusion is not an extremely rare condition there now being collected about 400 cases.

2. The occlusion is most frequently in the arteries.

3. By far the most common lesion produced is hemorrhagic infarction of the intestine.

4. The most common cause of the occlusion is embolism resulting from infection and injury.

5. There is no difference clinically between the arterial and the venous occlusion regardless as to whether it is due to embolism or thrombosis in the superior or the inferior vessels.

6. The clinical diagnosis should be made on sudden onset, acute colic like abdominal pain, distention and tenderness, signs of shock and collapse, often there may be vomiting and constipation if diarrhea is present it is almost always accompanied by melæna.

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## DISLOCATION OF THE SPLEEN

REPORT OF A CASE OF DISLOCATION OF THE SPLEEN INTO THE PELVIS AND ITS FIRM  
FIXATION ONTO THE UTERUSBy JOHN SALIBA B A M D C M ELIZABETH CITY NORTH CAROLINA  
S G Elizabeth City H pt I

**N**ORMALLY the range of the movement of the spleen is very slight. It moves with the diaphragm with respiration but not to the same extent as the liver. It is forced downward by a deep respiration. Its upper and anterior border move downward and forward a distance of 1 to 2 inches when the position of the body is changed from the erect or from lying on the back to lie on the right.

Abnormally the range of the movement of the spleen may be so great as to allow it to wander, float and lie in any part of the abdomen where it may become fixed in its new position. In its wide roving through the abdominal cavity a vagrant spleen is unsurpassed by any other organ. Its excursions into the pelvis are by no means of unfrequent occurrence. When it occupies a pelvic position the spleen may be mistaken for an ovarian or uterine tumor.

Owing to its displacement the spleen may become considerably engorged. Its pedicle may undergo a gradual or sudden rotation or twisting which may result early in an engorgement of the organ and later in its atrophy or may be followed by hemorrhage by peritonitis or by intestinal obstruction.

The effects produced by a wandering spleen on other organs are chiefly mechanical and are due to its dragging or pressure upon them or to its adhesion to or displacement of them. These factors may act either separately or in combination.

The causes that are responsible for the increased mobility and consequent dislocation of the spleen are: (1) Relaxation of its ligaments. This may be due to a general splanchnoptosis, to an increase in the size and weight of the spleen, or to a laxity of the abdominal walls. (2) Congenital anomaly. (3) Sudden trauma causing rupture of the supporting peritoneal folds. (4) Tight lacing.

In the diagnosis of a dislocated spleen we must rely on two points as our chief guides: first, we must prove the absence of the spleen from its normal position. This is rather a difficult matter for the anatomical position of the normal spleen cannot be palpated nor can it be ascertained with accuracy by percussion. Ventrally it is sheltered by the ninth, tenth and eleventh ribs. If felt below the eleventh rib it must be enlarged. The greatest amount of dullness of the spleen is over the tenth and eleventh ribs, above that the lung intervenes between it and the abdominal wall. Further, as the spleen is normally in contact with the cardiac end of the stomach and the splenic flexure of the colon, its position is affected by the condition of fullness or emptiness of these two organs. Dorsally the palpation and percussion of the spleen is also difficult owing to the proximity of the kidney and to the thickness of the muscles of the back. Second, we must find out if the previous history indicates the presence of a movable tumor which we can recognize as the spleen.

The rational treatment of a dislocated spleen is splenectomy. This is true if the spleen is healthy, but a dislocated spleen is rarely a healthy one and therefore splenectomy is often the operation indicated.

## REPORT OF CASE

S G woman, white, married, age 65, housewife, referred by Dr W C Stevens of Camden, North Carolina, was admitted to hospital on March 6, 1917. Her height was 5 feet and 8 inches and her weight 80 pounds.

She complained of a swelling centrally situated in the lower part of her abdomen, of a feeling of heavy weight in the pelvis, of severe indigestion, of habitual constipation and of painful defecation.

She had never enjoyed good health and her complaint was of many years standing. She had suffered from malarial fever. She stated that she had observed the lump in the lower part of her abdomen ever since she can remember and that her mother

told her she was born with it. She was never able to enjoy her food which consisted entirely of light soft diet. Her bowels never acted without an aperient. She always had a constant feeling of weight in the pelvis. Her menstruation began at the age of 16. It was of a fortnightly type, lasted five days and was very excessive. She has no dysmenorrhœa and no intermenstrual discharge. Her menstruation ceased at the age of 50. She had two pregnancies. The first at the age of 21 when she was delivered of living female twins; the second 10 years later when she was delivered of a living male child. Both births were normal. She had no abortion. She nursed all three children. During lactation her fortnightly menstrual flow did not cease. Her general appearance showed extreme emaciation. Her skin was sallow. She was nervous, irritable and anæmic.

**Physical examination.** Through the thin flabby abdominal wall there was evident a distinct swelling located in the median line at the lower part of the abdomen and extending upward about three inches from the pubes. It did not move during respiration. On palpation the tumor was felt to be tender when firmly grasped smoothly firm in consistence, dull on percussion, somewhat triangular in shape, and its base fixed in the pelvis. On bimanual examination to determine the relation of the tumor mass to the pelvic organs and tissues the cervix was found to be low down in the pelvis and the os looked downward and forward. The cervix was independent of the tumor. The tumor had no connection with the ovaries and the fallopian tubes. I made out the tumor to be connected with the retroverted uterus and so firmly attached to its fundus that on rocking the uterus from side to side and pushing it up from below the tumor moved with it. No separate mobility of either the uterus or the tumor could be made out. Rectal examination revealed the fundus of the uterus pressing against the anterior wall of the rectum and the presence of hemorrhoids. She had no urinary disturbances.

**Diagnosis.** In spite of the patient's statement as to the tenderness she felt when I firmly grasped the tumor and as to her observing the presence of the tumor ever since she can remember I made the tentative diagnosis of uterine tumor attributing her statement to an exaggeration due to her highly nervous and irritable condition.

**Operation and findings.** A low abdominal skin incision three inches in length was made in the middle line extending to the pubes. The pentonectomy incision was started high in order to avoid any injury to the bladder. The exposed tumor was found to be the spleen. It was somewhat triangular in shape. Its apex pointed upward, its left side and part of its posterior surface was adherent to the colon, its right side free, and its base thickened and grooved deeply in such a way as to ride astride the fundus of the uterus to the extent of one half of an inch anteriorly and one quarter of an inch posteriorly. The spleen which to all appearances was normal in

structure had the following dimensions: 13 centimeters at its greatest length, 6 centimeters at its greatest width, which was at the base, and 8 centimeters at its greatest thickness, which was also at the base immediately above its riding upon the fundus of the uterus.

The gastrosplenic omentum and the lienorenal ligament were not elongated as a general visceropexy was present and the spleen, the stomach and the kidney were displaced *tout ensemble*. The phrenocolic ligament was greatly lengthened.

I undertook first to separate cautiously the adhesions between the colon and the spleen with the fingers of my gloved hands following Rovings method. In doing this the capsule of the spleen became detached and a persistent oozing from the raw surface of the spleen took place. To control it I inserted two catgut stitches into the substance of the spleen and watched very carefully to the end of the operation for any hemorrhage, but none occurred.

The next thing was to decide which one of the following procedures should be carried out: first splenectomy—to dissect the adhesions to the uterus; tie the pedicle and extirpate the spleen; second supravaginal hysterectomy and splenectomy—to amputate the uterus through the cervix; tie the pedicle of the spleen and remove the uterus and spleen together without attempting to separate their firm adhesions; third hysteropexy and splenopexy—to fix the uterus and the spleen to the abdominal wall; fourth to close the abdominal incision without any further surgical interference.

Taking into consideration the patient's physical and constitutional condition on neither the first nor the second procedure could be carried out with any hope of a successful issue and therefore were contra-indicated. I chose the third procedure as I believed it would not throw any considerable strain upon the patient's system and would give her relief from such symptoms as weakness in the back and painful defecation.

The suspension was carried out as follows: First three sutures of No. 4 chromic catgut were passed through the anterior wall of the uterus 1 centimeter apart, the highest up being placed immediately adjoining the adhesions to the spleen. Second in spite of the fact that the spleen is a very friable organ and that severe hemorrhage followed in Greifenhagen's case where sutures were passed through the parenchyma of the spleen I was encouraged to adopt Tuffier's method because no hemorrhage occurred in this case from the insertion of the catgut stitches into the substance of the spleen to control the oozing which followed the separation of its adhesions to the colon. I passed two sutures of No. 4 chromic catgut through the substance of the spleen 2 centimeters apart, no hemorrhage followed. Before being tied the sutures passing through the uterus and the spleen were carried through the entire thickness of the abdominal wall with the exception of the skin and the subcutaneous tissue.

The patient left the hospital on March 22 1917 and although it may be too soon to record the final result she has reported recently that her symptoms were relieved that she has gained in weight and strength and that she is able to do household duties

This case is of interest because—

1 It is as far as my reading of the literature on the subject extends the first case on record where the spleen so shaped itself as to ride astride the fundus of the uterus

2 No hemorrhage occurred from the spleen when catgut sutures were inserted into

its substance at first to control the oozing following the separation of the adhesions to the colon and secondly to fix it to the abdominal wall. This might be due to a general increase of the fibrous tissue of the spleen which could not be verified without a microscopical section

3 An interesting question might be asked, viz was the excessive amount and the fortnightly type of the menstruation in this case due to an increased vascularity of the uterus caused by its adhesion to such a highly vascular organ as the spleen?

## TWO-STAGE OPERATION FOR CARCINOMA OF THE PREGNANT UTERUS UNDER PARAVERTEBRAL ANÆSTHESIA<sup>1</sup>

By CAITAIN NATHANIEL R. MASON M.R.C. U.S.A. Boston

A t t Ob l m d Gy ec l gy H ryard U n rs ty F r s t A t t v l g S u r g o f D i s t r i c t H o s p i t a l I W m B o l n C t y H p t a l

AND

FRANK C W. KONRAD M.D. Boston

F m A t a t O b t r i c U n r s t y F b k f b g / B T m p r y A t t l o t h S g f D I W m B t

**I**N the past it has been the custom in the presence of carcinoma of the pregnant uterus either to deliver the child and extirpate the uterus at the same time or simply to deliver the child by the abdominal or vaginal route. A fairly extensive review of the literature fails to reveal a single case in which a radical cure was attempted in two operations rather than in one. The purpose of this paper is to raise the question of the advisability of dealing with an operable carcinoma of the pregnant uterus by a cesarean section allowing the patient to convalesce and then at a second laparotomy to perform a hysterectomy. Most writers disregard the life of the baby if the tumor is operable and the life of the mother if the tumor is inoperable. If however we have a viable fetus and an operable tumor we must consider both the life of the mother and of the child.

The following is a brief review of some of the cases in the literature bearing on the subject.

Green (1) reports a case of a multigravida of 41 at or near term with a friable growth on the cervix

without apparent invasion of the broad ligaments or the vaginal walls. A seven pound baby was delivered by cesarean section and an immediate panhysterectomy was done. Drainage was secured through the vagina. The baby lived and was discharged in three weeks. The mother convalesced well until four weeks after operation when she developed an erysipelous lesion on the buttocks and died about two months after operation of general streptococæmia.

Locher (2) reports four cases in two of which the carcinoma was discovered postpartum after normal delivery per vaginam. In the third a cesarean was done but further interference was postponed because of the poor condition of the patient. The child lived but the mother died a few weeks later from exhaustion. The fourth case was a septipara 32 years old and thirty six weeks in her pregnancy. A cauliflower growth involving apparently only the anterior lip of the cervix was removed by complete excision of the anterior lip; there was severe bleeding. Six weeks later there was recurrence of the growth on the cervix and an immediate cesarean section was done followed by a panhysterectomy according to Wertheim. The uterine vessels were clamped before removing the child which was asphyxiated; it was resuscitated but died 25 hours after delivery. The mother recovered and showed no recurrence after six months. The author favors immediate cesarean section followed by a panhysterectomy according to Wertheim.

Stone (3) reports one case of a decipitous colored woman of 33 in the sixth month of pregnancy. She had had a moderate amount of menorrhagia previous to gestation then complete suppression for two months followed by irregular bleeding up to the time of treatment. A microscopic examination of a scraping from the cervix revealed carcinoma. A panhysterectomy, alone gland was searched for but none was found. The fetus was removed from the cervix specimen and lived two hours. The mother reported herself well twelve months after operation.

Holdforth (4) reports one case of a quadripara of 37 in labor. To hasten labor a Champetie de Ribes dilating bag was inserted but failed to have the desired effect. Finally the perineal gland was perforated and the fetus delivered by forceps extraction. A second fetus presented by the head and was extracted. The first fetus weighed five and one half pounds and died two days later. The mother showed no laceration of the cervix. Bleeding was controlled by pituitary extract and she made a good recovery. Ninety days later there was evident tension to the posterior wall of the vagina. Five and ten weeks later had rapid extension and much pain at the first consultation.

Herrgott (5) reports a case of a second para of 33. Her previous history was suggestive of disease of long standing. In her first pregnancy she miscarried at six months and had leukorrhea afterwards. She was cut three months after her miscarriage and had temporary relief. This was followed by a leukorrhea and menorrhagia up to conception. She had two months of amenorrhea and the beginning of haemorrhage at her regular menstrual time which later became haemorrhagic in character. At the time she reported she was in labor and the os dilated to the size of a fifty cent piece. Labor continued with good pains but with little or no progress and therefore it was decided to do a cesarean section. The uterus as entered the uterine incision was clamped the uterus incised and an asphyxiated male baby of 6 pounds was removed and resuscitated. A complete hysterectomy was then done to which the removal of a portion of the vagina. Thirty-nine days after operation there was no recurrence and the wound had healed completely. Nine months after operation reports seemed to indicate grave recurrence. The author favors the radical operation immediately on recognition of malignant growth.

Palm (6) reports a case of a tertipara in the third month of pregnancy. He did a complete hysterectomy according to Wertheim and discharged his patient relieved after five weeks. There was no later control.

Mylvaganum (7) reports the case of a septipara Hindu woman of 40. She had had menorrhagia, metrorrhagia and a foul discharge for seven months. Examination revealed an ulcerating cervix. This was cauterized and a vaginal hysterectomy was

done. A twin pregnancy of approximately three months duration was discovered in the removed specimen after operation. The patient was discharged from the hospital forty days after operation. There was no later control.

Jacobs (8) reports three cases as follows:

1. A tertipara with bleeding in the second month of pregnancy. Vaginal examination showed a friable cauliflower-like growth on the cervix. Immediate operation was advised but was refused. Three weeks later the patient had a hemorrhage. A complete hysterectomy was done with good immediate results. Eighteen months after operation there was recurrence and the patient died twenty months after operation.

2. A quintipara in her third month of pregnancy showed on vaginal examination a cauliflower-like growth on the cervix. Immediate operation was advised but was refused. Six months later at term the patient had a spontaneous delivery. The baby died shortly after delivery and the mother seven hours later from hemorrhage.

3. A quadripara in her second month of pregnancy reported with hemorrhage and jaundice. Vaginal examination showed an ulcerating crater on the cervix. Immediate operation was advised but was refused. Ten months later the patient miscarried but retained the placenta. A foul placenta was extracted and the uterus probably ruptured in the procedure. The patient died several days later.

The authors' conclusions are: If the tumor is operable disregard the pregnancy and do the radical operation at once. If the tumor is inoperable do only palliative treatment for the mother and save the baby.

There are more cases of carcinoma of the pregnant uterus in the literature but this review gives a fair idea of the different methods of procedure in this complication. All operators consider carcinoma of the pregnant uterus a grave complication and emphasize the fact that it grows more rapidly during pregnancy but none seem to recognize a temporary retardation of its growth coincident with the involution of the uterus. The physiological involution of the puerperal uterus is a well known fact and is it unreasonable to assume that the marked decrease in the vascularity of the pelvic organs following the delivery is accompanied by a delay or a temporary cessation of the growth of the uterine neoplasm? It will also be generally conceded that a panhysterectomy following immediately upon a delivery whether by the abdominal or vaginal route

is productive of more shock and loss of blood to the mother than would be produced by a simple cesarean section. It would therefore seem rational to postpone the hysterectomy if no harm is produced by the delay until such a time when the patient shall have recovered from the shock of the primary operation. The attempt to eradicate the carcinoma at the time the uterus is emptied presents great difficulties in operative technique on account of the pelvic engorgement. Porro's operation to be sure is readily carried out on the flabby uterus which can be drawn up easily out of the pelvis and the vessels encountered are of such large caliber that their ligation is simple but the extreme vascularity of the entire pelvis presents an almost insuperable obstacle to a careful and thorough pelvic dissection as is required for the performance of a pan-hysterectomy for the eradication of malignant disease of the uterus. The condition of the patient at such a time necessitates a more rapid and consequently less perfect operation thus increasing the chances of recurrence from carcinomatous tissue left behind. The time between the delivery and the hysterectomy should be sufficient only to allow the patient to recover from the shock and loss of blood accompanying the delivery but should not extend over the period of uterine involution. Thus the patient is in a better physical condition to withstand the shock of a careful operation for the complete extirpation of the uterus accompanied by a complete and thorough dissection of the pelvic glands. Even if a small amount of extension of the carcinomatous growth does occur during this waiting period it would seem to be more than counterbalanced by the heightened resistance of the patient which would markedly increase the safety and the thoroughness of the second operation.

Another factor in the reduction of shock is paravertebral anesthesia. Dr. Konrad will tell us later about this anesthesia and its advantages as compared with other forms of anesthesia.

My own patient who first interested me in the subject of this paper came under my

care at the Boston City Hospital December 1, 1916.

She had been sent into the hospital two days previously by her family physician. She was twenty-six years of age and had been married for seven years. There had been one child spontaneously delivered seven years before followed by a normal convalescence. The family history was negative. Her previous health had been good prior to the present illness. Menstruation began at fourteen occurred every twenty-eight days and lasted five days accompanied by considerable pain in the lower abdominal quadrants. Her last menstruation occurred about seven months before entrance to the hospital. Her present complaint consisted of irregular flowing for three months and of pain along the inner surface of the left thigh for ten days. Physical examination of the patient at entrance showed a fairly well developed but poorly nourished woman. Her general condition was poor; there was a marked anemia with a hemoglobin index of 55 per cent. The abdomen was distended by the pregnant uterus which extended to a point half way between the umbilicus and the ensiform cartilage. Vaginal examination showed a multiparous perineum and an indurated irregularly hypertrophied and congested cervix containing a crater one inch deep which bled easily. No infiltration could be made out in the vaginal roof.

Owing to the extreme anemia and weakness which the patient showed it was deemed inadvisable to carry out any radical operative procedure at this time. The vagina was packed firmly with sterile gauze to stop the active bleeding and the packing was changed whenever it became necessary. An attempt was made to improve the general condition of the patient by keeping her in bed in the open air, by forced nourishment and by the administration of tonics. Under this treatment the general condition became considerably improved and the hemoglobin content of the blood was raised from 55 to 70 per cent. But as the bleeding could not be controlled by keeping the vagina packed and as septicæmia was to be feared from the continued pack, radical interference seemed urgent.

Sixteen days after entrance to the hospital the patient was prepared for abdominal cesarean section under paravertebral anesthesia. In order to meet the urgency of hemorrhage with transfusion a male donor whose blood did not agglutinate the patient's blood was on hand.

The anesthesia included the segments from the eighth dorsal to the third lumbar inclusive and all of the sacral segments and was preceded by scopolamine-atropine seminaresis. The patient received 440 cubic centimeters of a one-half per cent solution of novocaine the equivalent of 2.2 grams of the drug and adrenalin 1:1000. The cesarean section required sixteen minutes. At all times the abdominal walls remained completely



relaxed. The patient remained quiet except for slight groaning at the manipulation of the upper angle of the incision.

The small seven and one half months baby cried immediately on delivery but died six hours later. After the *caesarean* section was completed the cervix was cauterized with the Paquelin cautery. At the beginning of the operation the patient had a pulse of 100 per minute during the anesthetization and up to the extraction of the fetus it rose to 160 per minute and then gradually fell to 104 per minute immediately after the operation. She was removed to bed took milk and water in the afternoon and passed a comfortable night following the operation without the aid of opiates. On the following day the abdomen was soft and but slightly distended. The temperature was 38.6 and the pulse was 120 per minute. She was given a head rest one hour in the morning and one hour in the afternoon. The appetite was good and there was no vomiting. On the second day after operation she was allowed out of bed. She continued thus to do well up to the sixth day after operation when the temperature rose to 38.9 and the pulse to 130 per minute. A profuse foul vaginal discharge developed but disappeared within a few days. On the tenth day after operation the temperature was again normal and the sutures were removed from the abdominal wound which was well healed. From this time on however she continued to run an irregularly elevated temperature highest in the afternoon and fluctuating between normal and 104. Her general condition however seemed to improve. Thirteen days after the delivery the hemoglobin index had risen to 80 per cent. In the meantime the pathological examination of the specimen removed at the time of the operation revealed epidermoid carcinoma.

Twenty-two days after the first operation the patient was prepared for panhysterectomy under paravertebral anesthesia. The pulse was 100 per minute and the temperature 101 on the morning of operation. A suitable donor for a possible transfusion in case of hemorrhage was again on hand.

This time the anesthesia included the segments from the sixth dorsal down through the sacral segments with the exception of the fourth and fifth lumbar segments and the patient received 25 grams of novocaine in 500 cubic centimeters of 0.5 per cent solution. The laparotomy was preceded by a cauterization of the cervix and inversion of the stump. The uterus and ovaries with as much of the vagina as possible were removed. Some difficulty was encountered in freeing the bladder but bleeding was moderate. A gauze drain was inserted into the vagina from above to drain the pelvis. During the anesthetization and cauterization of the cervix the pulse rose to 163 per minute. At the beginning of the laparotomy the pulse was 142 per minute and then gradually fell during the operation to 118 per minute rising

again to 148 per minute by the end of the operation. The patient was quiet during the entire operation which lasted two hours and twenty seven minutes from the beginning of the cauterization of the cervix to the closure of the laparotomy incision.

At seven o'clock that evening the patient on being questioned did not remember what had happened from 5 o'clock in the morning till two o'clock in the afternoon and was not aware of having been removed from the ward. She ran a rather stormy convalescence with the pulse ranging around 120 per minute and the temperature between 38.6 and 102. The vaginal drain was removed three days after operation and a week later a discharge of urine appeared from the vagina and persisted. The general condition improved slowly. On the eighteenth day after the second operation she was up and about and on the twenty ninth day she was discharged on her own request. An examination at this time showed a small sinus in the middle of the abdominal wound discharging a thin yellow secretion. The entire pelvis was rather resistant to the examining finger and somewhat nodular on the right.

After leaving the hospital the patient returned to unhygienic home conditions where she began to fail steadily. During the last two months of her life she was in a private hospital under the care of a private physician who reported that there had been a progressive loss of weight and strength accompanied by an irregularly elevated pulse and temperature. There was almost no complaint of pain. She refused nourishment during the last few days of her life becoming unconscious on the day before her death which occurred four months and eighteen days after the first operation.

It seems fair to consider that the two stage operation prolonged this patient's life for it is extremely doubtful that she could have survived a panhysterectomy following directly upon the *caesarean* section or even a spontaneous vaginal delivery. The extent of the malignant growth when the patient was first seen made the ultimate outlook practically hopeless.

The writers raise the hope of a cure for carcinoma of the pregnant uterus by the two stage operation in such cases in which the disease is detected in the early stages and which permit of a more complete operation than seemed possible in this instance.

#### PARAVERTEBRAL ANÆSTHESIA

In paravertebral anesthesia as the name implies the anesthetic is placed outside of the spinal canal about the vertebrae and in close proximity to the nerve trunks as

they emerge from the spinal canal through the intervertebral foramina. The field of operation is anesthetized segmentally by blocking each segment separately. This is done along the back by using the ribs in the dorsal and the transverse processes in the cervical and lumbar regions as guides. A needle of appropriate length is introduced vertically over the bony landmark and pushed forward till it meets its resistance. From this fixed and easily located point it is not difficult to find the nerve as it emerges from the spinal canal to pass underneath the inner border of the rib or transverse process. There may be variations in the bony landmarks but the nerves always follow these so that guided by them the needle point can always be brought into close proximity to the nerve and as this is an infiltration anesthesia proximity is all that is desired. For instance in the dorsal region the needle is introduced on a level with the spinous process about four centimeters from the median line and pushed vertically inward until the point strikes the rib thus the rib belonging to the process next above is located. Now withdrawing the needle nearly to the skin the angle is changed so as to let it pass just underneath the rib and the needle pushed one half to three quarters of a centimeter deeper. The point of the needle now lies in the intercostal space into which 15 cubic centimeters of a one half per cent solution of novocaine with 1:1000 adrenalin is injected. This is repeated on both sides until the desired field is anesthetized.

For the sacral segments a slightly different scheme is followed. Here the nerves do not pass backward but come forward and spread out over the anterior or inner surface of the sacrum. To reach them a needle 15 centimeters long is pushed through the perineum at a point on a level with the tip of the coccyx and 1.5 to 2 centimeters from the median line. The needle is pushed forward parallel to the horizontal and sagittal planes of the body. Thus it invariably meets a resistance at or near the second sacral foramen in the hollow of the sacrum at a distance of about 8 centimeters from the tip of the coccyx. By raising the angle of the

needle with each introduction the third fourth and fifth segments may be successively located. The injections are made while gradually withdrawing the needle so as to inject in a line over the sacral nerves and infiltrating this entire area.

The first sacral foramen is located by depressing the needle about ten degrees from the horizontal and pushing it forward until it meets a resistance it should pass about 1.5 to 2 centimeters deeper than for the second foramen.

Because the sacral nerves spread out over the inner surface of the sacrum a larger quantity per segment is injected here than in the dorsal or lumbar regions namely 20 cubic centimeters per segment or 200 cubic centimeters for a complete anesthesia of all the sacral segments.

Preceding the anesthesia patients are given 10 grains of veronal on the night before operation, one two hundredth of a grain of scopolamine and one half of a grain of narcephin two and one quarter and one and one half hours respectively before operation. In patients that are cachectic or weigh under one hundred pounds three fourths of this dose is given. If necessary to keep the patient absolutely unconscious one half of the above dose may be repeated at no less than one and one half hour intervals. This preliminary semiconsciousness is necessary to eliminate the psychic shock and phlegmatic patients will need less of this particularly if the anesthesia is perfect. In fact if she so desires a patient may remain fully conscious during the operation the injections are less painful than it would seem. However I give it as a routine.

The only general reaction that I have observed outside of the anesthesia is a slight temporary pallor due to the adrenalin and a temporary rise of the pulse which I attribute to the amount of fluid injected. The blood pressure is not noticeably affected.

The anesthesia continues from 2 to 4 hours and then fades out gradually. Occasionally lip and throat dryness from the scopolamine becomes annoying but this can be counteracted by sips of water even during the operation for patients rarely

vomit and if so from other causes than the anæsthesia. Shock is practically eliminated by this combination.

#### ABSTRACT OF DISCUSSION

DR E. B. YOUNG, Boston. As Dr. Mason has mentioned at the time the patient was first seen I thought that her physical condition was such as to make any radical interference extremely precarious. The disease appeared to me to have extended too far into the parametrium and we know that in pregnancy and immediately after confinement malignant disease spreads very rapidly.

DR HENRY T. HURCHINS, Boston. Dr. Mason kindly asked me to see this patient. The case at the time seemed to be inoperable as far as a permanent cure was concerned. It did seem advisable however for something to be done to relieve the bleeding and discharge. The patient was anæmic, frail and gave one the impression that the loss of eight and the weakened condition were due to the invasion of malignant growth rather than to the loss of blood which the patient had sustained. It is to be regretted that after the painstaking case which Dr. Mason used in every detail that the patient could not have been relieved for a longer period if not finally completely cured.

DR STEPHEN RUSHMORE, Boston. My experience with carcinoma of the cervix and pregnancy is limited to two cases. One of these was seen very early on account of bleeding and I was somewhat interested in the carcinoma that I overlooked the pregnancy. When I saw the patient a month later

and told her she was probably pregnant in the third month she regarded my first diagnosis as an error and I have never seen her since. I am told now several months after the birth of her child that she is in very poor health but I have not been able to get her to come to see me nor send me any word about herself.

The second case I operated on in the fifth month of pregnancy removing the whole uterus with tube and ovaries. This patient lives outside of Boston and I have not seen her since she left the hospital sixteen months ago. Her physician told me recently however that she is apparently in excellent health.

The principles formulated by Dr. Mason seem sound and if at the cesarean section the internal iliac arteries are tied involution would probably be much more rapid and more complete at the time of the hysterectomy.

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# DEPARTMENT OF TECHNIQUE

## FORMALDEHYDE-PHENOL IN CAMPHOR PARAFFIN

### A NEW WOUND ANTISEPTIC

By KARL CONNELL M.D. NEW YORK

THE combination herein described was the result of a laboratory survey by new methods of the various clinically useful antiseptics. A preliminary trial of this antiseptic in the traumatic crushed wound of civil surgery at the Roosevelt Hospital, New York, has demonstrated that it is a powerful and efficient combination of time tried antiseptics. It combines the rapid sterilizing action of formaldehyde with the slow embalming action of phenol. The painful properties of the former antiseptic and the local and general toxicity of the latter agent are mitigated by dissolving them in an anhydrous, slowly spilling reservoir, namely, the camphor paraffin solvent.

The purpose of this combination was to produce an antiseptic of high efficiency and lowered toxicity which when employed as the first major surgical dressing together with efficient drainage in the surgery of the advance dressing station may possess such power of diffusion through organic matter and such permanency of bacterial inhibition that the crushed infected tissue of the war wounds may reach the service of the rear well drained without extending infection or local putrefaction.

In working out the relative merits of various proprietary antiseptics for the Research Committee of the Medical Section of the Council of National Defense it soon became evident that new laboratory methods must be devised in order to gauge rapidly the wound efficiency of antiseptics. The writer has been chiefly interested in the problems of the Surgery of the Advance. In this zone often times because of military exigencies as in time of intense activity and in open campaign the wounded cannot be redressed for days at a time. The ideal antiseptic agent for this zone should therefore possess together with a rapid surface sterilizing action also a wide penetration through blood clot and crushed tissue and an embalming action continuing for at least four days together with

the physical properties of remaining in the wound and not blocking drainage. Although the determination of the phenol coefficient gives a rough index of the antiseptic value of a given chemical yet it is not applicable to oily and solid substance nor does it simulate the conditions under which the antiseptic must remain efficient in the average wound.

To sort out those antiseptics which in addition to antiseptic action as determined by the phenol coefficient tests also possess some power of diffusion through organic matter and which retain antiseptic virtue in the presence of organic material a series of tests were devised by the writer collaborating with Dr. William Elser, Professor of Bacteriology, Cornell Medical School.

These tests were designed to gauge the antiseptic diffusion distance under various conditions approximating those existing in the wound.

*Summary of study.* On to a 5 centimeter column of solid agar thinly seeded with staphylococcus aureus 2.5 centimeters of the antiseptic was superimposed. The tube was then incubated and in 6 hours a good growth of discreet colonies became visible in the agar except where in a certain zone of agar directly beneath the layer of antiseptic no bacterial growth had occurred. The measurement of the thickness of this clear zone yielded a basis of comparison between the various antiseptics. Carefully measuring in millimeters the depth of antiseptic penetration thus demonstrated and comparing the square of this measurement to that obtaining in a control tube employing a 5 per cent solution of phenol in liquid petrolatum as the comparative agent a proportion is yielded which the writer has termed the Elser phenol coefficient of antiseptic diffusion. With 5 per cent phenol this zone of inhibition usually measures 15 millimeters in thickness varying slightly with various batches of culture media and strains of bacteria. Yet as compared to the usual phenol coefficient deter-

mination this diffusion coefficient is remarkably constant and the test gives a graphic picture of the effective penetration of an antiseptic into solid media of low organic content.

The method seemed useful in that it rapidly elicited out those antiseptics known to be of clinical value and branded others of doubtful repute as feeble or inert and furnished a new standard of comparison. The method was therefore developed further employing ascitic agar and finally fresh human blood clotted in blankets of the desired thickness on the agar column as the organic medium through which the antiseptic must diffuse. On to this the antiseptic was pipetted and the depth of 6 hours incubation gave a clear idea of the penetrating power of a given antiseptic through blood clot sufficient to inhibit bacterial development. A further test in another set of tube the antiseptic was mixed with varying proportion of blood liver and muscle pulp for varying period of time and then superimposed on the agar tube illuminating certain questions as to the action of antiseptic in the presence of organic material.

The method is described in a forthcoming article in the *Journal of Bacteriology*. Only a rough summary is given below of the work which furnished a basis for the formulation of antiseptic herein described.

These tests extended over three months in the Laboratory of Bacteriology, Cornell Medical School by Dr William Elser and Dr Frank Huntoon and at the Harriman Laboratory of the Roosevelt Hospital by Florence Hulton Frankel Ph.D. They were incomplete and of necessity hastened by war emergency yet they yielded the following information:

**a Heavy metal group** Mercury is the only metal which possesses as an element or in combination as a salt any substantial power of diffusion to act as an antiseptic. All salts of mercury soluble and insoluble possess the power of diffusion through solid menstruum of low organic content. Of the mercury compound mercuraphen diffuses the most widely. However all mercury salts in clinical strength possess little power of penetration through blood clot and become bound and ineffective when mixed with crushed tissue. Metallic mercury itself exercises a remarkable power of diffusion in habituating and sterilizing for a zone of at least 5 millimeter in all directions (Elser diffusion coefficient 11/100). In ointment even in dilution as low as 1 per cent of metallic mercury it maintains this power of diffusion. Thus mercury ointment inert by ordinary methods studied by

this method justifies the clinical confidence that is generally placed in it.

**b Halogens** Iodine in itself has limited power of diffusion. It diffuses best from solution in paraffin oil. In the tincture the diffusion distance is much less than that of the alcohol in which it is dissolved. Iodine possesses practically no power to penetrate blood clot and belongs in the class of perishable antiseptics of utility in the presence of organic matter only when supplied in heavy dosage.

**Chlorine** In clinically employed percentage chlorine diffuses more widely than solid or saturated iodine. Like iodine it possesses no power to penetrate blood clot except when present in caustic dosage or in with free alkali. It is not an embalming agent but belongs in the group of perishable surface antiseptics. When it is entirely combined with organic matter such material becomes an improved culture medium for bacteria. Chlorine therefore to be clinically useful must be frequently renewed as by the Drakin Carrel method or continuously supplied from a capacious chemical reservoir as from dichloramun oil.

The other oxidizing substances are so feeble as scarcely to deserve mention.

**c Aromatic series** To this series belong the only antiseptics possessing power of wide diffusion through organic matter together with lasting embalming action in such dosage as may be employed without intoxication. Many of the aromatic oils possess mild power of antiseptic diffusion eucalyptol being a prominent example (coefficient 16/100).

The dye stuffs (flavine etc.) justified no confidence. In fact the only remarkable antiseptics were the time tried phenol and formaldehyde. Of the phenol group phenol itself manifests the highest efficiency surpassing the cresols the saponified phenol and saponified cresols and other antiseptic. It diffuses equally widely from oil (paraffin) as from water but little inhibited by the presence of excess of organic matter penetrates blood clot widely and acts as a permanent preservative or embalming agent.

From a diffusion standpoint the most potent antiseptic of all is formaldehyde. This possesses an agar diffusion coefficient unapproached by that of any other antiseptic (1 per cent aqueous solution = 1400/100) together with a remarkable penetration of blood clot (320/100). Formaldehyde falls short of phenol only in the permanency of its antiseptic action. Formaldehyde in such concentration as can be employed clinically loses the larger part of its antiseptic

properties in twenty four hours when in contact with organic matter

In combining the known clinical with the experimental data on antiseptics it seems probable that the choice of antiseptic for repeated application must fall in the perishable iodine chlorine group and that the choice for permanency of single first dressing must fall in the phenol and formaldehyde group. It is improbable that any one antiseptic or compound can accomplish all desired results.

Iodine seems clinically available slowly yielded from a chemie reservoir such as hexamethylenamin tetraiodid (80 per cent available iodine) or from a physical reservoir such as a saturated solution in paraffin oil (0.8 per cent available iodine).

Chlorine seems at present available from an aqueous source frequently renewed as the Dakin hypochlorite solution or monochloramin or from hexamethylenamin tetrachloride or better from a more capacious and lasting anhydrous reservoir such as dichloramin in eucalyptol.

For the first sterilizant and embalming action on fresh wounds in the surgery of the advance dressing stations probably the only efficient antiseptics are in the aromatic series. Balsam of Peru and eucalyptol represent the mild types phenol and formaldehyde the powerful and toxic types. A combination of these two latter antiseptics present so many points of advantage over the dichloramin in eucalyptol for the first application that such combination awaited only some way to control the toxicity to establish clinical superiority.

As to control of toxicity, long experience with the solutions of phenol in camphor both in civil and in war surgery has demonstrated that this solvent eliminates in large measure the dangers of phenol poisoning. Phenol diffuses so slowly from solution in camphor that a large reservoir of phenol may be supplied (30 per cent or more of phenol in 70 per cent or less of camphor) from which the phenol flows slowly as a wound embalming agent without the local caustic action and the dangerously rapid absorption that has placed aqueous phenol in disrepute. The diffusion from camphor (30 per cent of phenol) is less than half in total amount that diffusing from equal volumes of 5 per cent aqueous solution. (Ratio diffusion 12 times greater from water than from camphor.)

The toxicity of formaldehyde is largely local. Formaldehyde has long been employed in traumatic surgery as a powerful local disinfectant but it is extremely painful and the use of aqueous

solution stronger than 1:1000 causes many hours of suffering. From glycerine the formaldehyde diffuses less rapidly and glycerine as a solvent somewhat mitigates the pain and allows clinical usage up to 1 per cent but glycerine like water solution is too evanescent and becomes washed from the wound. In an endeavor to lower the diffusion coefficient and stabilize a large body of formaldehyde I passed this gas into camphor phenol and found that it readily entered into solution up to 0.5 per cent and that by the addition of alcohol to the camphor phenol as in the Chlumsky formula 1 per cent or more of formaldehyde could be dissolved. Clinical trial of this solution on fresh wounds at the Roosevelt Hospital New York demonstrated that the formaldehyde thus dissolved in camphor phenol no longer caused agonizing pain. Even in strengths up to 1 per cent it caused only transitory smarting probably mitigated on account of the slow diffusion of the formaldehyde from the anhydrous solvent and because of the anesthetic property of the phenol camphor. The Elser diffusion coefficient of phenol 30 per cent in camphor was raised by the addition of 1 per cent of formaldehyde from 66:100 to 445:100.

Thus a wound antiseptic combination of high efficiency seemed available. Clinical tests of this combination on lacerated wounds at the Poosevelt Hospital New York justified the theoretical confidence. The soiled and crushed wounds of civil surgery healed promptly without evidence of infection or chemie trauma indeed much better than with tincture of iodine and slightly better than with dichloramin in eucalyptol. However repeated application to open wounds showed distinct evidence of chemie insult to the tissue. The preparation is therefore too powerful and permanent in its antiseptic action for use as redressings after the normal wound barriers are established. In this latter field this combination in nowise competes with the halogen antiseptics.

The next problem was to improve the physical character of the antiseptic whereby first the formaldehyde would be prevented from evaporating out and second whereby the antiseptic would be held more permanently in the wound and third to supply advantageous drainage properties to the antiseptic.

As to the necessity of these improvements I found that on exposing the liquid solution in a watch glass at 36.5° C. the formaldehyde largely evaporated out in 24 hours but that on solidifying the combination by the addition of 10 per cent of hard paraffin the formaldehyde was held. Second it has been my experience with camphor



ESSENTIAL POINTS IN THE METHOD OF HERNIA OPERATION<sup>1</sup>

By A. BENJAMIN KEYES, M.D., F.A.C.S., CHICAGO

Sg Cook C. H. Capt. M. R. C. Surg. Ad. y B. d. 3C. Ch. g.

THE very large number of draft army incisions incapacitates from recurrent inguinal hernias and after abdominal operations often in clean cases but especially if drained prompt me to reiterate some of the common essentials in the methods of performing hernia operations and closing abdominal incisions which I have found withstand best the violent sudden increases of intra abdominal pressure to which men in the army and navy are subjected

## INGUINAL HERNIA OPERATION

The four inch inguinal hernia incision between the anterior superior spine and the pubis through the skin and the superficial and deep superficial fascia should be as bloodless as possible for the better appreciation of each separate anatomic layer

Pass the director obliquely into the inner angle of the external ring

Divide the external oblique fascia from the inner angle obliquely upward and outward leaving as wide a lower external oblique flap as possible

Pass the finger under the upper flap of external oblique and expose the tendinous portion of the internal oblique

Pass the finger under the lower flap of the external oblique baring and following along Poupart's ligament to its pubic attachment

Lift the spermatic cord *In oblique inguinal hernia* inspect the spermatic cord—in sheath—carefully. The edge of the white hernia sac can often be seen

Tear through the cord sheath only near the white edge seize it and wipe cord downward entirely off from hernia sac open the sac apically slit down the whole length pull up strongly and free the sac base to the parietal peritoneum level transfix the emptied sac low and tie and excise (if a sliding hernia exists suture the sac opening at the parietal peritoneum level avoiding injury to the sliding viscus or its circulation (*In the low neckless direct inguinal hernia* beware of the bladder open the sac between the forceps as in a laparotomy as high up as possible avoiding deep epigastric vessels)

Loosen cord well at upper angle to allow of a longer new inguinal canal floor

Insert interrupted sutures from the higher upper cord angle (*under the cord*) coapting entirely the *tendinous* part of the internal oblique and conjoined tendon to Poupart's ligament (Three or 4 mattress sutures one half inch apart suffice) (Poupart's should be exposed by the left index finger hooked over the lower—external oblique—flap and never dragged on by forceps which will injure and tear important fascia but will not expose the real Poupart's ligament but only an edge three-eighths inch above it) Do not tie now

Sutures external to the cord at Ferguson's angle are also often necessary

Draw all the cord floor sutures *urgically* tight at one time so that the tendinous part of the internal oblique and conjoined tendon coapt with Poupart's ligament throughout hold so coapted then tie separately clench knots not granny's

*Now place the cord down on its new floor*

The external oblique upper flap is now brought down covering the cord and the edge sutured in its entire length interruptedly as near to Poupart's ligament as possible

The external oblique lower flap is now laid over the upper flap and its edge sutured interruptedly along the upper margin above the spermatic cord ridge line or higher to make a fairly tight imbrication

*Close the skin* incision with clips or silkworm sutures. A bay band silkworm drain to be removed on the fourth day should be placed between the deep superficial and external oblique fasciae (Good chromicized No. 3 or larger catgut or kangaroo tendon should be used for deep sutures)

The above method carefully carried out on a field kept bloodless by the double application and division between forceps of all blood vessels the thorough drawing up and thorough freeing of the sac to its very base and tying low the thorough loosening of the cord at its upper angle and beginning the first internal oblique Poupart's ligament suture high up and the others at regular intervals making a longer floor for the cord canal the drawing of all of these floor sutures surgically tight at one time before tying thus avoiding poor coaptation (which with the perfect clench knot are very necessary



to insure a successful operation) also the interrupted suture of the upper external oblique flap the edge of which if sutured down as near to Poupart's ligament as possible acts as a support to the internal oblique Poupart's sutures and allows of a better imbrication by the lower flap over it making a strong double layer of external oblique fascia above the cord

The Wood McIwen Bassini Marcey method of doing hernia operation have unfortunately so often been subjected to very unsatisfactory change some of them devoid of anatomic justification such as insufficient freeing and low tying of the sac or not lifting the cord thereby inviting a recurrent direct hernia or suture the weak red friable internal oblique muscle to Poupart to form the floor or edge to-edge slack closing coaptation suture of

the two external oblique flaps or placing the cord between the two imbricated external oblique layers thereby rendering the imbrication useless have all aided in bringing about the incapacitation of too many of the young men otherwise physically fit for army service

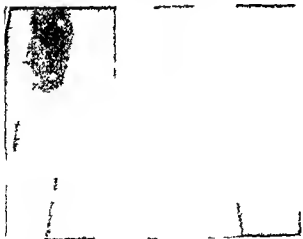
#### IN LAPAROTOMIES

In all umbilical and ventral hernias and closure after laparotomy where no hernia previously existed sutures by stages like to like with imbrication of the fascia give a very much firmer wound closure In all drained laparotomy cases imbrication is a necessity if hernia is to be avoided—the drain being preferably placed at the middle of the wound where the imbrication is widest and never at the end where the imbrication is least

## END-RESULT WITH A BONE PLATE ON A FRACTURED FEMUR

By CARL C. SWANSON, M.D., F.A.C.S.,  
Hospital

A boy aged 3 years injured a femur at the distal end of the right femur September 8, 1914. Examination showed a comminuted fracture of the right femur.



The patient was taken to the operating room on September 11, 1914, four days after the injury. A bone plate and screws were applied to the femur. The patient was discharged on September 18, 1914, and returned to the hospital on October 1, 1914, for further treatment. The patient was discharged on October 1, 1914, and returned to the hospital on October 1, 1914, for further treatment. The patient was discharged on October 1, 1914, and returned to the hospital on October 1, 1914, for further treatment.

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The animal bone plates and screws used in this case were devised by Dr. E. J. Brown and A. C. Locke and they have reported good results in 31 cases at the Passavant Hospital.

Fig. 1 (A) Before operation.  
Fig. 2 (B) After operation.  
Fig. 3 (C) After operation.

#### CONCLUSION

Bone plates are preferable to metallic plates for two reasons: (1) absorption takes plates and bone plate and screws; (2) bone plates retard osteogenesis less than metallic plates. Furthermore, bone plates are absorbable and removable in less cases than if metallic plates were used.

## CEREBRAL HERNIA

## A METHOD FOR ITS SURGICAL TREATMENT

By ARNOLD SCHWYZER MD FACS St PAUL MINNESOTA

**D**URING the present war there has been a large number of injuries of the head and our medical journals have given us numerous accounts of them. For instance in the May 1917 number of INTERNATIONAL ABSTRACT OF SURGERY there is an article giving the experience of Sargent and Holmes with the late results of gunshot wounds of the head as they observed them in the London hospitals. After excluding from 1239 cases of head injury the superficial ones and the recent and uncertain cases there remained 610 patients with serious injuries. Of 6 cases from whom the missile had been removed by operation 6 developed hernia cerebri with 2 deaths. Out of 69 cases with the missiles *in situ* 14 developed brain hernia with 2 deaths. In the 68 cases of through and through shots 14 developed cerebral hernia. Four out of the 14 died. Out of 310 cases of penetrating wounds without retained missile 86 reached England with cerebral hernia. Nineteen of these died and in 18 other ones the wounds were not yet healed at the time of the report. Thus among the 610 cases of severe forms of cranial injury these two authors alone observed the formidable number of 120 cases of cerebral hernia. I shall not attempt to go further through the literature. I simply picked out the above observation as an example.

Probably the large percentage of infection in the wounds in the present war is an important causative factor in a great number of the cerebral hernias. The protrusion is probably due to an edema of the brain substance caused by the infection.

While brain hernia due to cranial defects without an open wound may be repaired in many ways as by free transplantation of bone or other material or as we have done for instance with a large defect in a young child by pedunculated flaps of pericranium combined with free bone transplantation our difficulties in brain hernias in the presence of infection and loss of the covering skin and soft material are greater.

For this reason I feel induced to publish a procedure which we employed in one instance and in which a plastic closure of the cerebral hernia at the top of the cranium not only apparently differed from that generally used but also

gave a very satisfactory result. A report of the case in which this procedure was used follows.

On October 7 1910 Doctor Gendron of Plover Fall Wisconsin kindly referred to me a patient about 40 years old who on September 3 while in a silo had been injured by a galvanized iron pipe which weighed 25 pounds falling on his head from a height of 30 feet. It struck him with the sharp edge on the posterior portion of the midline between the parietal bones and it cut into the brain substance to a depth of an inch or so. Dr. Gendron reached the patient who was unconscious 45 minutes after the accident. About 2 tablespoonful of brain substance had oozed out. The hemorrhage though of course the longitudinal sinus had been divided was not alarming. The wound was 5 to 6 inches long. The inner plate was much splintered and bent down. In prying the bones apart to remove the splinters a sudden deluge of blood came from what the doctor judged to be the longitudinal sinus. The hemorrhage though fearful was soon checked by iodoform gauze and finger pressure. Then some more loose pieces were removed and the wound was packed tight with iodoform gauze which was held firmly in place by sewing the skin over it. This gauze was later on gradually removed the last of it eleven days after the injury. There was no rise in temperature at any time beyond 99.5, the pulse was about 88 or 90. The patient was very dazed. The eyesight at first seemed gone but gradually returned. The appetite was good and the wound looked good. However since the packing was removed a cerebral hernia started for which the patient was referred to me on October 25, ten to twelve weeks after the injury.

The general condition of the patient apart from a certain dullness was quite good. The examination of the eyes showed no restriction of the field of vision on the right side. While an object approached from the left was not differentiated until practically the axis of the eye was reached. This homonymous hemianopsia meant in our case of course an injury to the cortical field of vision or its optic radiation fibers in the right occipital lobe.

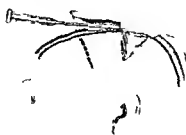
The wound had been kept clean and looked good. The extent of the brain hernia can best be judged from the sketches which were exact in size and proportion though the whole wound was a little farther back on the cranium than shown in the pictures. The wound was about 5 to 6 inches long. The width of the bony gap in the center was a little over one inch.

That portion of the protruded brain substance which lay outside of the inner level of the bone was now removed. The outer parts of the removed brain substance were shown to be necrotic. Hemorrhage was stopped by sponge pressure and clamps. A chain of deep sutures was then inserted surrounding the whole field.

An incision through the scalp to the bone was now made about two inches anterior to the wound parallel with it and of equal length. Underneath this flap the external table was chiseled free from the skull. This external table was carefully left in continuity with the scalp bridge. Some slight infraction occurred of course but this mobilized bony shell together with the overlying bridge of the soft tissues formed one firm well finished



1



2



Fig 3

Am t l th t l k d l l m l  
bo t h l t t t d l t d s  
f th b v def t  
Aft fl t fre z f t t t t t t t t  
gl l f l b d k i h d d p l b k l l l  
th l e f t l b v r l h l l l h l d t h f m  
t f a l y d j t h t t t d l l l t h b d g e  
ell h d l t  
Th w f t p t t l b d k l l m a l l t h  
th l t t m f t h l b v t t d g d p  
nt th l t l t f t h l b k th s  
p n d d l t t h l p l b m l l t p e  
l b l k d k t l t h l t d k t l l d  
l l a l d d l t t l d d t l l d g  
f d d t l t t l  
l l d y f t l t r t m l t n t t h t  
l l p t t m t l l t a i t m l p t  
l m f t u l g f t t h d l s t d y  
ft p e t t h t t t l h m f h t m p d  
l u h d h d g o d t h p e l j m p d  
i t f b d flap r p d l l b

Mt r th p t a th f t l l f b a n  
b t t l t h b h d t h p l t c n p h a n g  
t m t h d h m l y A b u t y f t e r t h e p a t n  
th p t t m d h g u l w k  
t t p t s a y h m d d w e l l w t h o  
t b t t l l d f t t h g h t f e h y a  
h m v m l f t d e d h m p

It would seem that this method of a bridge flap including the external table which is slid over the defect in the skull in the manner of a visor or of a helmet would be practicable in most regions of the skull. The dependably secured nutrition for the flap, the firm and steady pressure of the flap upon the defect, the degree of which can be chosen by the greater or less width and obliquity of the pedicle of the bridge and finally the hermetic bony closure of the defect are the outstanding benefits of this procedure.

## BLOOD TRANSFUSION SIMPLIFIED BY THE USE OF CITRATE OINTMENT

### THE BIOLOGIC TEST FOR BLOOD-INCOMPATIBILITY

By HENRY W. ABELMANN, M.D., Chicago

IN the last three years I have given blood transfusion a great deal of attention and study, and the results which I have obtained are flattering to the superlative degree. I am convinced the blood transfusion when properly handled is entitled to be classed among the best therapeutic measures in treating certain diseases

conditions. Owing to difficulties and risks it has seldom been used.

However, with the modern improvements in technique as well as the new test for blood incompatibility, the difficulties dangers and inconveniences have been largely overcome and at the same time the therapeutic results have been

improved. In recent years Lindeman, Kimpton, Lewisohn, Percy, Brewer, Crile and others have accomplished much in reviving and making popular blood transfusion.

The method which I have developed has for its chief object simplicity and safety and this is true as well of the new test for blood incompatibility. The technique and the instruments have been perfected for the purpose of providing a way and means by which the transfusion of blood can be accomplished by one person with certainty and ease without any assistance also with the idea of eliminating dangers and inconveniences which in the past have caused the physician to hesitate to employ this valuable therapeutic measure in the treatment of disease. I use the syringe method only and have perfected it by the invention of an ointment to prevent the coagulation of blood.

That blood coagulation and blood incompatibility are the chief obstacles to be overcome cannot be denied. While the ointment is a highly effective anticoagulant medium the new test which I call the biologic test for blood incompatibility makes for safety in transfusion. This test has shown that there are different types of incompatibility and that we do not merely have to deal with hemolysis and agglutination; furthermore I have found that the biologic test is far more accurate and much more simple than the laboratory tests. Many of the fatal and disastrous results which have occurred in blood transfusion have undoubtedly been due to the administration of blood which the laboratory tests have failed to prove toxic. Fatalities have also followed the transfusion of too great a quantity of blood (massive transfusion) in very anemic individuals. In three years I have given over 1500 blood transfusions and I have not had one fatal result or a serious mishap to record. My experience in blood transfusion has been largely in treating certain anemias and chronic infections and it has many times proved to be a lifesaving procedure where medicine and surgery have failed to restore health. I have used it on patients who have had to undergo major operations but were too weak and debilitated to be operated on and repeatedly their condition has been improved in a short time so that the operation could be performed with but little risk. I have used transfusion to hasten the period of convalescence after operations and in patients debilitated from long continued fevers. Blood transfusion has been a successful therapeutic measure to allay pathologic hemorrhage not infrequently it is effective in relieving pruritus and

good results have been obtained in patients afflicted with nervousness and sleeplessness.

As the simplicity of the modern methods and the safety with which the operation can be performed as well as the advanced therapeutic value of hemotherapy become better known blood transfusion will have its field of usefulness extended and it will be more generally employed than it is at the present time.

#### METHOD

The blood is aspirated from the vein of the donor into the syringe the inner wall of which has been covered with a thin coat of the citrate ointment. By this procedure a known quantity of blood can be aspirated while its injection into the vein of the recipient is under absolute control. Speed and dexterity are not required to carry out the transfusion successfully and no anticoagulant solutions which have their disadvantages are necessary.

I have found that the transfer of small doses of blood (10 to 40 cubic centimeters) at intervals of 3, 5 and 7 or more days according to the indication or judgment of the attending physician not only is safer for both donor and recipient but also is productive of the best therapeutic results. I use the Luer (all glass) graduated 100 cubic centimeters and the Luer 5 millimeter (hypodermic) syringes. The larger syringe is fitted with a short rubber tube 3 centimeters long. By using the flexible connection between needle and syringe it is possible to hold the syringe in various positions and at the most convenient angle without affecting the position of the needle thus minimizing the possibility of traumatizing the vein. The rubber also protects the nipple of syringe from clipping.

*Transfusion needles* (Figs 1 B and B) The transfusion needles which I have devised possess certain features which are of particular advantage. The needles 4 centimeters long 18 or 19 gauge slip joint and interchangeable with the syringes are provided with a guide which indicates the correct position of the cutting edge of the needle and serves as a gripping portion lending ease and control to the operation and also by means of which it can be handled without the danger of contamination. The wings which spread from under the proximal end of the needle serve to embrace the vein without compressing it thus assuring the free flow of blood. The claws at the distal end of the wings serve to fix the needle which prevents its slipping out of the vein or piercing its posterior wall. When the needle is placed on the tray the wings serve to

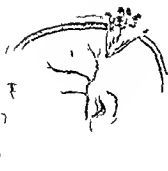


Fig 1



Fig 2



Fig 3

em c I th nt l ck ti b brnd. d  
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 t l t r m f th u n l i v t r t n l p l p  
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 v b l k d k t l t l l b a l s j l d  
 a d a g a l n e d n f l t m l d d th b n i c  
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 T l d y f t th j r t m l th t e t a t  
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Att th op at th o f th lo f b a  
 b t n the s tu l n l h d the p l s t c f l h e g  
 t r m p l y d i m l y t b t a y r a f t th p e t  
 th p t t m d h r g u l a r w o k  
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 l z t u t s t l l d f t n th g h t f h y a  
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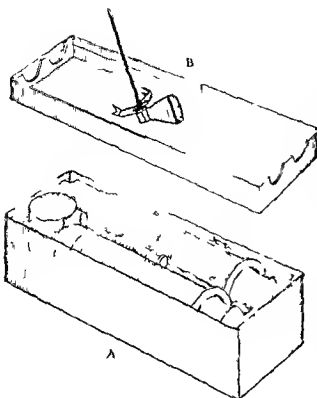


Fig 1

keep the gripping portion in an upright position thus enabling the operator to pick up the needle with ease while the shaft of the needle is directed upward at an angle of 45 degrees whereby inadvertent contact and the rubbing off of its coat of ointment is prevented. The needle has a flat cutting edge which works much more satisfactorily than a pointed one. After being properly prepared the syringes and transfusion needles are packed in sterile gauze and placed in a container (see Fig 1 A). They are then ready for immediate use in any emergency. The extension cover of the container (Fig 1 B and Fig 1 A) is utilized as a syringe tray its construction being such that when employed for this purpose it has stationary syringe holding portions accommodating two syringes holding them in properly spaced relations and preventing them from rolling (thus avoiding breakage). They also serve in keeping the transfusion needle and pistons in the sterilized field (thus avoiding contamination). The syringe holding portions also prevent the piston from sliding which obviates the inadvertent dripping of blood or the entrance of air into the syringe. The extended portion of the cover serves as a drip pan and, telescopically engaged with the remainder of the cover

*The ointment* When I first began to employ blood transfusion I used a citrate solution in conjunction with petrolatum. After some time I came upon the idea that an ointment having for its chief ingredients sodium citrate and petrolatum would save time and simplify the operation and I set about to compound such an ointment. After much experimenting I found that adeph lanæ which is anhydrous was the most suitable for the purpose. The following formula gives the best results: Adeph lanæ 10 aqua de stillata 10 natrium citratis 10 petrolatum q ad 100. The specific action of the natrium citratis and the petrolatum is enhanced by the adeph lanæ which makes it possible to combine the natrium citratis with the petrolatum. The ointment aside from serving as an effective anticoagulant has other important functions to fulfill which are necessary for the successful transfusion of blood. In the first place it hinders blood from intruding between piston and barrel of the syringe thus preventing sticking of the piston. It also hinders air from being drawn in at the proximal end of the syringe during the aspiration of blood so that the syringe can be filled to its full capacity (120 cubic centimeters). The ointment possesses an excellent lubricating body which facilitates the easy sliding of the piston. It provides a medium which excels the covering property of petrolatum and possesses sufficient adhesive quality to cling to the syringe and needles without loosening and getting into the blood.

*The preparation of syringe* It has been my experience that repeated sterilizing of the syringe by boiling eventually break them therefore I sterilize my syringe in alcohol except when working with a new set for the first time then I boil them 25 to 30 minutes. When sterilized with alcohol care must be taken that all the alcohol has been evaporated which is accomplished by aspirating and expelling sterile hot water (not boiling water). The syringe are then taken apart and after a few seconds they are dry and ready to be coated with the citrate ointment. A small quantity of the sterile ointment is heated to the liquid state and taken up into the syringe. By holding the syringe in an upright position and by moving the piston slowly up and down the inner wall of the syringe is covered with a thin coating. It is advisable to stir the heated ointment well before aspirating it into the syringe. The piston is coated by dipping or pouring hot ointment over same. The excess of the ointment is forced out of the syringe while it is still hot to prevent the occlusion of the small parts of the

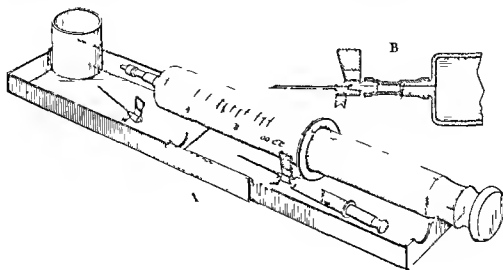


Fig. 1

syringe. Since employing this method of sterilization no syringes have been broken during the two and one half years in which I have used it whereas previous to this breakage by boiling was not an infrequent occurrence. The needles can be anointed by attaching them to the hypodermic syringe and aspirating and expelling the hot ointment.

**Preparation for transfusion.** The instruments are placed on the syringe tray (extended case cover) on sterile gauze. Next test the transfusion needles to make sure that they are not occluded with the ointment. This is done by attaching them in turn to the hypodermic syringe and taking up and forcing out the following solution: per cent natrium citratis in 0.8 per cent NaCl solution. Then attach needles to their respective syringes. When the syringes have been properly prepared and tested there is no danger of injecting ointment into the vein. The needle as well as the rubber connection and neck of syringe is filled with the solution (2 to 3 cubic centimeters) for the purpose of excluding the air in these parts. The instruments are now ready for the transfusion.

**Preparation of recipient and donor.** The patient and donor are brought in a comfortable recumbent position. The flexor surface at the bend of the elbow is sponged with 95 per cent alcohol and a moderately tight tourniquet is placed around the arm of both donor and recipient. I employ rubber tubing about 7 centimeters long and 0.7 centimeter in diameter. Two such tubes are used as a tourniquet. The double tube works more satisfactorily and assures a more uniform compression. They are applied in such a manner that when pulling one of the ends the tourniquet

is easily and quickly removed. Experience has taught me that palpation of the vein is the best guide to ascertain whether or not the tourniquet is too tight or too slack. The proper compression will keep the vein constantly refilled as aspiration goes on and will prevent the wall of the vein from being sucked into the mouth of the needle thus assuring the free flow of blood. The forearm should be held in extreme extended position. The closing of the hand tightly will compress the deep veins making the superficial ones still more prominent and also less collapsible thus rendering the puncture of the vein easier. It is always advisable to use sharp needles; dull needles will collapse the vein or push it aside causing pain unnecessary traumatism, ecchymoses besides making the puncture of the vein difficult. The arm must be dry (free from alcohol) before the puncture is made.

**Aspiration of blood.** The transfusion needle is thrust into the most prominent and best accessible vein of the donor. It should enter the vein in the direction of the blood current as it affords the most convenient position for aspirating blood. The valves in the vein will sometimes obstruct the free flow of blood by being aspirated into the end of the needle; experience will teach how this can be avoided. The blood is aspirated slowly and steadily and when the syringe is nearly filled (100 cubic centimeters) the tourniquet is removed. The donor's hand is now opened and the excess of blood in the vein is aspirated before the needle is withdrawn. A sterile sponge (kept in readiness) is applied to the puncture wound the donor making compression with the finger over or just below this point until the operator has completed the transfusion when a loose binder is applied which





Fig. 3

is left on for at least 12 hours. By placing the middle of the binder on a line over the site of puncture bringing one end around the back of the arm and the other around the back of the forearm then tying them over the front of the elbow free motion in the joint is allowed while at the same time the slipping of the bandage is prevented.

Now place the syringe on the tray and then remove the needle.

If the above technique is properly carried out it is not likely that extravasation of blood into the subcutaneous tissues will take place.

**Injection of blood.** Another transfusion needle attached to the hypodermic syringe which is filled with 10 millimeter of the solution is thrust into the most prominent and accessible vein of the recipient. As soon as the needle enters the vein the blood pressure will push the piston outward which is sufficient proof to the operator that the needle is in the lumen of the vein. The tourniquet is now removed and the hand opened and the contents of the hypodermic syringe emptied into the recipient's vein. The removing of the tourniquet and opening of the hand relieves the intravenous pressure which in conjunction with the capillary force of the needle prevents bleeding when the hypodermic syringe is disengaged. The blood filled syringe is now connected to the needle in the arm and its contents injected slowly into the recipient's vein. If more than 10 cubic centimeters of blood is to be transfused two syringes are filled with blood and placed on the tray and injected in turn. The puncture is treated as mentioned above. When repeating the transfusion I usually use the same puncture wound.

It is interesting to know that the instruments aside from being useful in blood transfusion are also admirably adapted for any intravenous medication (salvarsan etc.). Blood letting which is being revived and which is a valuable therapeutic measure is rendered very simple and easy by the use of the apparatus.

An easy way to sterilize the solution and always have it ready for immediate use is to fill a dozen four ounce bottles half full of the solution and place them in a water bath and boil them 30 minutes (cork can be boiled at the same time). The content of one bottle is poured into the solution cup (which is attached to the transfusion tray) and is sufficient for to insert the needle to make sure that they are in good working order as well as for rinsing out of syringes and needles after the completion of the operation which renders cleaning easier at a subsequent time. The ointment in the syringes is wiped out with sterile gauze and the ointment in the small parts is removed by a piratin and expelling sterile hot water. They are then ready for the alcohol bath.

#### BIOLOGIC TEST FOR BLOOD INCOMPATIBILITY

The physiologic reaction following the injection of the donor's blood into the recipient's vein manifest itself by certain signs and symptoms (early manifestations) which indicate whether or not the prospective donor's blood is suitable for the transfusion. In performing the test the same technique is employed as for the transfusion except that the larger syringe is filled with 40 cubic centimeters or more of the solution (1 per cent sodium citrate in 0.8 per cent NaCl solution) into which 20 to 40 cubic centimeter of the donor blood is aspirated. As even small

quantities of incompatible blood may give rise to severe reactions it is necessary to so dilute the donor's blood as to render the injection safe. The severity of the reaction is further controlled by injecting the blood slowly and in small quantities (1 to 2 cubic centimeters) at intervals of 10 to 15 seconds while at the same time closely observing the patient. The following are some of the signs and symptoms which for simplicity sake are given promiscuously without regard to any particular type of blood incompatibility.

Flushing of the face, feeling of oppression in the chest, increased respiration and shallow breathing pain in the sacral region (headache, nausea and vomiting rarely occur except when larger and concentrated doses of highly toxic blood is injected). Any one or a combination of one or more of the above mentioned signs and symptoms usually appear in one to five minutes after the injection and disappear in about five minutes. They are usually followed by a chill (late manifestation in from 20 to 45 minutes). After the chill one or more of the following symptoms may arise: elevation of temperature, perspiration, tired and sleepy feeling, yawning, aching of the muscle, hæmoglobinuria, etc. If an experienced operator performs this test patients suffer very little inconvenience from the reaction as the injection is at once discontinued when signs of incompatibility begin to manifest themselves. Should no signs of incompatibility occur after a period of three to five minutes the remaining blood in the syringe can be safely injected. It happens that certain types of incompatible blood will not produce the initial symptoms but will give rise to late manifestations (chills, etc.). In my experience blood of this nature is seldom found but if it is it has proved to be less toxic.

I have repeatedly demonstrated that blood of moderate incompatibility when given in small doses can bring about beneficial results without apparent harm to the patient and that absolute compatibility is not always essential. This however can be graded best by individual experience. It is also to be remembered that blood of a mild toxic nature is liable to become more toxic with subsequent transfusions (manifestations of anaphylaxis?). Should the blood of the first donor prove to be incompatible it is advisable to wait until the late reactions have passed over before another test is made. It is perhaps best for the beginner to familiarize himself with the new test by using the laboratory tests first and supplementing them with the biologic test in this way doubly safeguarding the

patient from the danger of blood incompatibility until ample experience has been gained. This subject will be touched upon again under the heading "Special and Important Advantages of the Method."

It goes without saying that the donor must be healthy. A thorough physical examination should be made and the history carefully taken. Blood examinations are often helpful in determining the existence of infective disease and where the slightest suspicion exists they are imperative. Individuals between the ages of 18 to 25 years are best suited for donors.

#### SPECIAL AND IMPORTANT ADVANTAGES

*The administration of small quantities of blood.* The transfusion of a small dose of blood (120 to 40 cubic centimeters) at intervals as the condition of the patient warrants not only brings about the best results in treating certain chronic disease but also frees blood transfusion of many of its dangers.

*Repeated transfusions.* An important safeguard for both donor and recipient lies in the fact that the transfusion of blood can be repeated at chosen intervals. The practical application of this is rendered possible by the simplicity of the method as well as of the apparatus. The taking of large quantities of blood at one time often leaves the donor in a weak and debilitated condition which renders him easily susceptible to disease. Cases are known in which the immediate and even the remote effects of large withdrawals of blood proved fatal. My experience has been that with the extraction of small quantities donors usually make up for the loss of blood by gaining in weight during the intervals of transfusion. In no case have there been to my knowledge any untoward effects as the result of withdrawing small doses of blood at chosen intervals; on the contrary many of the donors feel better after this procedure. The recipient's blood-making organs are stimulated by small and repeated transfusions as shown by the increase in hæmoglobin during the intervals of transfusion. It is the increase in the patient's own blood which is induced by the repeated transfusions that adds to the efficiency in treatment and frequently less blood is required to bring about results when it is administered in small and repeated doses. Massive transfusions not only invite certain dangers but are often less effective in treating chronic anæmias.

With the administration of large quantities of blood especially to patients suffering with high grade chronic anæmia the strain and shock to the weak and anæmic organs is great. The

heart in particular is over taxed in its effort to force blood of a greater viscosity through the capillary system. As the laboratory tests are not always reliable the transfusion of large quantities of unrecognized toxic blood is liable to cause alarming symptoms and even death which may result suddenly or in a few hours or days. This danger is practically eliminated by the small repeated transfusion as well as by the use of the biologic test for blood incompatibility.

**Blood incompatibility.** The biologic test is a very important safeguard developed by this method. In the large number of cases in which I have performed this test it has proved to be safer and more satisfactory than the laboratory tests. It is so simple that the average physician can usually determine within one to five minutes and with a maximum degree of certainty whether or not the prospective donor's blood is suitable for the transfusion. Furthermore it has repeatedly demonstrated the unreliability of the laboratory tests and has shown that there is more to blood incompatibility than mere hemolysis and agglutination. Although the modern improvements in laboratory testing of blood have diminished the danger of blood incompatibility nevertheless a certain amount of danger exists. Besides laboratory tests require expert work, are time consuming and are more or less complicated.

I have employed the biologic test only during the first two and one half years with gratifying results. Whether or not it is advisable to recommend its general use in this way (especially to the beginner) is an open question. It will perhaps (in the hands of the average transfusionist) be employed as a valuable and necessary adjunct in testing for blood incompatibility and as a double safeguard in blood transfusion.

**Therapeutic blood test.** The chief factors in hemotherapy on which much of the success of treatment depend. I believe lies first in the selection of compatible blood for the patient and second in the selection of suitable blood for the disease. To my knowledge the selection of suitable blood for the disease has never received attention. While the blood to be transferred may be compatible it is not always said that it is also suitable to combat the disease. This has been my experience in several cases in which healthy compatible blood had been transferred without much apparent change in the patient's condition. However upon electing another donor whose blood was also healthy and compatible the patient improved rapidly with the diseased parts clearing up simultaneously. The most plausible explanation of this phenomenon

seems to be that the blood of the first donor offered little or no resistance to the particular germ while the blood of the second donor proved to be noxious to the infectious microorganism. The fact that the chemical make up of blood differs offers at least one explanation why some individuals are less susceptible to certain infectious diseases than others. It is obvious that this therapeutic test will enhance the value of blood transfusion in the treatment of disease.

**Dangers eliminated.** The method precludes the possibility of transmitting disease from patient to donor as the patient's blood at no time comes in contact with the donor. The danger of air and clot emboli also thrombosis and infection is practically nil. The possibility of contracting (anaphylaxis?) is minimized owing to the greater reliability of the biologic test. The danger of acute dilatation of the patient's right heart by too rapid transfusion of blood is avoided as the rate of flow of blood into the patient's vein is under absolute control also the exact amount of blood aspirated and injected is known.

**Incunabulae overcome.** The transfusion can be performed by the average physician with safety and ease in a short time and without the aid of any assistance. The operator requires no speed or dexterity (the blood does not clot). The method requires no cutting consequently there will be no offensive scar, no destruction of blood vessels and nerves and no wasting of blood. I have repeatedly transfused blood without spilling a drop. The operation requires no local or general anesthetics as it is practically a painless procedure. Donors are readily secured on account of the simplicity, safety and convenience and are not incapacitated from attending to their work. For obvious reasons professional donors are undesirable subjects. In fact I have never employed them as the friends or relatives of the patients have always been willing to serve as donors.

The transfusion can be performed in the physician's office with the donor and recipient sitting at a table (see Fig. 3). Upon completing the operation both parties can be dismissed immediately. Before office treatment can be undertaken however it is necessary that the blood incompatibility be previously determined. This is usually possible after the first transfusion. As the psychological effect of a new blood may cause fainting it is advisable to restrain the donor and recipient from watching the operation.

The apparatus is compact can be carried in a coat pocket, is easily sterilized and prepared and can always be kept ready for immediate use in

any emergency. The instruments are also admirably adapted for the administration of salvarsan and other intravenous medication. Blood letting is rendered simple by the use of the

apparatus. On the whole the citrate ointment syringe method of blood transfusion should appeal to the average physician as the most desirable routine method.

## CÆSAREAN SECTION LOCAL ANÆSTHESIA

By HUGH H. TROUT, M.D., POANOKE, VIRGINIA

IN presenting this paper we appreciate fully that we have employed local anæsthesia in some cases in which there were no contra indications to a general anæsthetic. However, as all such patients have had so little pain and no shock, we feel justified in having followed this course in order to test the practicability of a method to be applied in those cases in which a general anæsthetic adds gravity to an already grave situation.

Since Einhorn gave to the surgical world novocaine most of the major operations of surgery have been performed with its use, but a search of literature failed to show an abdominal cæsaréan section done with this anæsthetic up to the time of our first case. However, since then Dr. Clarence Webster reported fourteen cases in *SURGERY, GYNECOLOGY AND OBSTETRICS*, February, 1915. Most of his cases preceded our work along this line and he certainly deserves all credit for priority.

In our series we have had 18 cæsaréan sections done with local anæsthetic and a considerable number of others with general.

Why this field of surgery has not been more utilized by the advocates of local anæsthesia is difficult to understand for frequently where the necessity for such an operation is present the contra-indication to a general anæsthetic is marked and we are convinced the procedure offers few real difficulties and can be done with relatively little pain—certainly nothing like as much as normal labor.

It is of course necessary for any surgeon attempting this work to be accustomed to the employment of local anæsthetics and any operator expecting to gain entrance painlessly into the abdominal cavity should certainly be familiar with the great work of Lennander on the sensibility of the various viscera and parietal peritoneum. Curious to note Lennander does not mention the sensibility of the uterus either in the pregnant or the non pregnant condition

further than to state. All organs receiving their nerve supply only from the sympathetic nerve and from the vagus below the branching off of the recurrent nerve have no sensation. According to my observation therefore the abdominal and pelvic viscera are devoid of nerves to convey the sense of pain, pressure, heat or cold.

The truth of the above quotation has been impressed upon us very forcibly during our operations on the pregnant uterus, namely the patients have no pain when the uterus is being incised but do complain of nausea and pain to much traction which latter condition is what would be expected but certainly the former state of affairs is an important and somewhat unexpected observation. We have purposely told four patients before we started to incise the uterus and none have complained of pain during the entire incision but all did have pain when we lifted the child and membranes from within the uterus. This of course helps prove Lennander's contention that there is pain to the lightest traction on the mesentery or parietal peritoneum. This point is further demonstrated in the fact that in all 18 of our cases the most painful part of the operation was the lifting of the uterus out of the abdominal cavity.

The technique of the operation as we have followed it is briefly as follows. Operation preceded by morphia  $\frac{1}{8}$  novocaine  $\frac{1}{2}$  of 1 per cent with three drops of adrenalin to the ounce is the solution employed and of this we have used as high as 250 cubic centimeters. In the last 11 cases we have omitted the adrenalin and could see no difference in the duration of the effect of the anæsthetic or the amount of bleeding.

The skin is infiltrated in the usual manner by forming one wheel after another. In the first five cases we made the incision from the pubes upward until we could have room to deliver the uterus but during the last thirteen we made the



Fig. 1



Fig. 2



Fig. 3

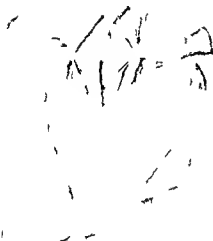


Fig. 4



Fig. 5



Fig. 6

middle of the incision about the level of the umbilicus and the upper end about on a level with the fundus of the pregnant uterus (Fig. 1). The fascia is infiltrated exactly in the same manner as the skin and muscle are usually so that the fibers separate without trouble. A small opening is then made in the peritoneum and index finger of left hand inserted and peritoneum infiltrated keeping this finger on the inside as a guide for the needle while injecting this very thin membrane. This part of the operation is far easier than is commonly supposed. The uterus is lifted out of the abdominal cavity and moist sodium citrate and sodium chloride pads or towels placed between it and the intestines.

It is important to have the upper portion of the abdominal incision placed so as to be slightly higher than the fundus of the pregnant uterus and in this manner the uterus can be allowed to rise out of the peritoneal cavity thus removing what is sometimes the only painful part of the operation. If the incision is not too long the abdominal wall will hug the uterus and serve to retain the intestine without the use of pads, etc. (Fig. 2).

As a matter of precaution and to save time after incision of the uterus we place a line of interlocking sutures of chromic catgut on each side of the fundus of the uterus (Fig. 3). The sutures are about one inch apart. The sutures are

placed as follows. The points of entrance and exit are about  $1\frac{1}{2}$  inches apart. The next suture has its point of entrance half way between the two above points and this manner of inserting sutures is continued until about eight to ten sutures are placed in each side of the future line of incision. As these sutures are placed in the direction of the long axis of the uterus it is easily seen a line of sutures so placed will interlock one another and control all bleeding. These sutures go through the whole muscular wall and an assistant on each side makes traction on the entire line thus lifting the uterus up steadily the same and controlling the hemorrhage (Fig 4). After delivery of the child and membranes these sutures are tied across the line of incision and in this manner we have at least eight double mattress sutures which not only control the hemorrhage but give fairly accurate approximation (Fig 5). This whole suture line is covered over by means of a continuous suture of plain catgut approximating the peritoneal surfaces leaving no raw surfaces for future adhesions (Fig 6). The abdominal incision is closed in the usual manner.

The following is a very brief synopsis of the eighteen cases

## ECLAMPSIA — 9 CASES

Three mothers died all having had convulsions before operation six children were born dead three living. There was very little dilatation of cervix in any of these cases. Forceps delivery was attempted previous to operation in all three cases that died no forceps in the remainder of the series. All cases having had convulsions presented an aura of radiating epigastric pain. There were 11 primiparae and three multiparae.

## CONTRACTED PELVIS — 5 CASES

All mothers living, three children living and two born dead.

## PLACENTA PREVIA — 2 CASES

Both mothers living

## PYELOPHRITIS

One case of pyelonephritis as not relieved by urethral catheterization etc. and the patient was very toxic. The mother is living, the child born dead.

## UTERINE INERTIA IN PRIMIPARAE — ONE CASE

There was one case of uterine inertia in a primiparae. The patient was in labor over 48 hours without any dilatation and collapse of mother.

The mother and baby are living.

From our experience with those cases we are convinced where the condition of the mother makes the giving of a general anæsthetic unsafe the employment of novocaine is indicated and its use does not present the difficulties one would naturally expect.

## THE ACTION OF "FEMALE REMEDIES" ON INTACT UTERI OF ANIMALS

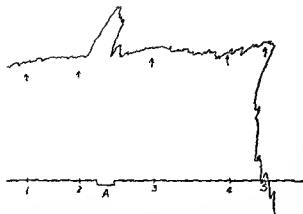
By J. D. PILCHER, M.D. AND ROY T. MAUER, OMAHA, NEBRASKA

L. b. t. r. y. i. P. h. m. l. g. y. S. h. o. o. l. M. d. U. n. i. v. i. n. b. k.

THIS paper concludes the study of the so called *female remedies*. In former publications<sup>1</sup> it has been shown that while a number of these preparations affect the activity of strips of the excised uterus they have a similar action on strips of intestine so that the action was considered to be on smooth muscle in general and not specific to the uterus. Further from the concentration of the solution necessary to demonstrate their actions on excised tissues it was concluded that doses too large to be tolerated would be required to display a similar action on the intact organism. The present study was undertaken to settle the questions for there was a possibility that the drugs might influence the uterus through a central action although there is no pharmacological basis for this view.

*Methods.* The movements of the uterus

were registered after the method of Barbour. The fallopian tubes of the anesthetized animal were freed from their adnexa and supported in a glass cylinder that was fastened in the belly wall and communicated with the abdominal cavity. The abdominal cavity and the cylinder were filled with warm paraffin oil thus immersing the uterus in a warm inert fluid. The contractions of the uterus were recorded. Cats, rabbits and dogs were used, the last being much more satisfactory. With but one exception all the animals were non-pregnant as they are more suitable for the method employed. One dog in the very early stages of pregnancy gave similar results. The blood pressure from the carotid artery was simultaneously registered in the experiments on dogs but because of the lack of resistance of cats and the rabbits it was thought



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of th nt tut rus fa gn dog Th pe r r a  
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c ts b ec l (r z f) the drug r in j cted by n  
d ses of a b t m t per kl gr m j m l h  
wood p l all d bl h h pe t l Th l e  
m d a on trat f abo t r ooo n the bl od it  
a small d e of h tam n g e d t s n j to of  
ep phr n the latt r g th l t f ll bel th  
base f h t in nt upt l b t i l f

best to omit the blood pressure records on these animals after preliminary work had shown that the blood pressure was unaffected by all the drugs except blue cohosh.

The rabbits and cats were etherized and pithed through the foramen magnum; curare was not required in the pithed animals. The dogs received a preliminary injection of morphine sulphate (3 to 5 mg per kilogram) and were then etherized and lightly curarized. Barbour ( ) demonstrated that morphine was practically void of action on the contractions of uteri of cats and rabbits and our work on dogs confirms his observation. For the uteri contracted well in all the experiments. A large dose (about 3 mg per kilogram) of morphine sulphate was given by vein in a single instance and caused a marked temporary increase in tone at the same time the blood pressure fell much below normal but soon returned to the previous level; this result also confirms Barbour's findings.

**Dosage.** It was aimed to give the maximum amount of the drug so that the concentration in the blood would approximate that (1:1000) of the solutions used in work on the excised uterus. Considering the total quantity of blood as about 5 per cent of the body weight it would require 0.04 cubic centimeter of the fluid extract per kilogram of the animal weight to reach this concentration. This dose would be from 10 to 100 times the adult dose of most of the preparations used. Further the drug was always given by

vein which would make the concentration proportionally larger for the remedies are ordinarily administered by mouth. The doses used then were always several times larger than the ordinary therapeutic dose. Even larger amounts were administered in a few experiments but because of the heavy precipitate of resins formed by diluting the extracts with saline solution it was thought best not to employ them for intravenous administration.

**The experimental results.** The following drugs were examined and were found to be without action (Fig 1): unicorn root, pulsatilla, Jamaica dogwood, figwort, valerian, lady's slipper, wild yam, life root, skull cap, blue cohosh, black haw (*Nitthum prunifolium*), cramp bark, squaw vine, false unicorn, passion flower and motherwort.

The experiments were made under various conditions when the tone of the uterus was considered to be normal when it was much above and much below normal when the uterus was contracting normally with unusual or very slightly or not at all. The question of the tone of the uterus is emphasized because it is claimed that some of these drugs at least are both tonic and sedative and the results demonstrate that they are neither the one nor the other.

All levels of blood pressure from 180 millimeters to 50 millimeters of mercury were present. Control experiments (epinephrine) gave the normal reaction at low level of blood pressure. Because of the normal variations in the activity of the uterus it was necessary to perform a somewhat larger series of experiments than would have otherwise been warranted usually at least six to eight experiments were made with the drugs that had been shown to be active on the excised uterus while but two or three injections were made of the inactive one. When results other than negative were obtained they were not uniform that is instead of the uterus being either uniformly stimulated or depressed the results were variable. When an atypical result was obtained the rule was to follow it shortly by a second injection of the same drug to be sure that it was an atypical result. In the experiments on dogs control injections of epinephrine which

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p m l m p b b (v b m p l l f sc tu (C) m  
(Le ru m d p ) f f u l nc ) d m th ort

inhibits the contractions and lessens the tone were made and occasionally histamin or pituitary extract which increase tone in all cases the normal action of the control drugs were obtained

*The effect on the blood pressure* Although the drugs were injected rapidly into the vein to insure the maximal action there was no effect on the blood pressure with the exception of two drugs with the larger doses (0.04 cubic centimeter) of blue cohosh in the dog there was always a severe fall in the blood pressure of from 30 to 50 millimeters with a fairly prompt return to normal. Immediately following the injection the uterine movements were usually not affected but at times there was either an increase or decrease in tone of considerable degree even in the same experiment however the results did not agree as in one case after the first injection the tone was increased and the contractions lessened while after the second injection the tone was decreased and the contractions became larger this could only mean that the changes in contraction were not due directly to the drug or they would have been uniform. Doses of blue cohosh which did not change the blood pressure were without effect on the contractions of the uterus in the experiments on both the dogs and the cats while in the latter animals blood pressure records were not made in the experiments

in which the uterine movements were registered the large dose did not affect the blood pressure in control cats. Control experiments with epinephrin that did not change the blood pressure gave the usual decrease in tone and contractions. A fall in blood pressure in itself may have no effect on the curve for passion flower twice caused a sharp fall in blood pressure without altering the uterine contractions

#### CONCLUSIONS

The experiments demonstrate conclusively that the entire list of *female remedies* are quite void of action on the uterus *in situ* thus confirming the interpretation of the results of the work on the excised uterus and intestine. They cannot therefore influence the tone or contractions of the uterus through any central innervation or through the blood stream no matter whether the uterus is in a state of normal increased or decreased tone. The following drugs were all found to be inactive in doses that were far above the average therapeutic dose: unicorn root, pulsatilla, Jamaica dogwood, figwort, valerian, lady's slipper, wild yam, life root, skull cap, blue cohosh, black haw (*Viburnum prunifolium*), cramp bark, squaw vine, false unicorn, passion flower and motherwort.

## CORRESPONDENCE

### BROWN'S IMPROVED HODGEN SPLINT

January 13, 1918

*To the Editor* From recent textbooks reports in surgical journals and photographs of the splint most commonly used in the war for treatment of fracture of the femur I infer a Hodgen frame suspension has been found to be the most satisfactory solution of the problem. Before any modification of this splint shall be accredited to any one now working at the front I beg to recall to your attention an article which appeared in *SURGERY, GYNECOLOGY AND OBSTETRICS* for May 1908 entitled "An Improved Hodgen Splint for the Treatment of Fractures of the Thigh or Other Painful Affections of the Lower Extremities" by Dr. George S. Brown of Birmingham, Alabama, now deceased. In this paper which he read before the Southern Surgical Association at New Orleans, December 1907, will

be found a full description of the splint as modified by him and all the points which have been recently claimed for it as to accuracy of result, simplification of dressings in compound wounds, comfort to the patient and ease in nursing care will be found fully discussed therein. His elimination of expensive and cumbersome trestlework over the beds, positive adjustment, continuous pull and many other details make the recently described splint as used in the war seem crude and in an evolutionary stage to those familiar with Brown's work. It is with an idea of giving credit for practically complete refinement of the details and management of this splint to the memory of Dr. Brown where it properly belongs that I ask the favor of publication of this letter.

JOSEPH A. MACLAY

Paterson, N. J.



# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 1 1918 DR CARL BECK PRESIDENT

### OSTEOMYELITIS OF THE FEMUR DISARTICULATION OF THE PELVIC GIRDLE

DR B I LANSBURY This case of osteomyelitis is one of absolutely standing and was finally treated after the manner illustrated by Dr Beck at the last meeting. The case originated as an acute osteomyelitis of the lower end of the femur. There was great swelling and pain and within a week accompanied by a high temperature. The bone was opened and considerable pus and necrotic tissue removed. The channel was kept open by a drain. The wound continued to discharge pus for months through a narrow sinus. Finally Beck placed a drainage tube into the cavity. The discharge persisted even after repeated injections. The hole channel was packed up again and a wider drainage attempted but ultimately the process could fill in with granulation leaving a small sinus with foul smelling discharge. About six months ago a sliding skin flap operation was done as described by Dr Beck. The flap was slid in from the side and held in the bottom of the bone channel. One of the flaps sloughed at the point where it turned over the edge of the bone. Fortunately the other lined and epithelialized on as long as the channel is nearly covered. There are only a small spot at the bottom which still bare but it is gradually being covered with epithelium.

The other case is that of a young man who fell from the cab of an engine landing on his buttocks on the right side. The injury was so violent that it disarticulated his pelvis separating the symphysis pubis and the sacroiliac joint. The left ilium innominate bone with the right thigh could be pushed up until the crest of the ilium rested on the short ribs. There was no separation of the acetabulum at the symphysis. The ilium was driven up and on the sacrum about 21 inches. There was rupture of the urethra but the urinary excretion was normal. There was very little traumatic shock. The patient was kept in bed for a fortnight. His leg lost 13 pounds until all the acute reaction of the tissues had subsided. He was then put on a Hiley table and the displaced innominate bone pulled down a large flap was turned up over the symphysis eliminating the rupture articulation. The external iliac vessels were moved from beneath the pubic bone and they were placed to either side of the bone. The pine of the pubic bones were cut off and clamped up and placed between the ramus edge of the ilium and the

pubis. The patient turned on his face for the operation on the sacroiliac joint. The entire sacroiliac region was exposed with a flap incision. The ilium was forced downward on the sacrum and a hole drilled through the ilium into the sacrum. The cartilage was removed from the entire joint surface and the edges of the bones made raw. A bone peg was driven through the ilium into the sacrum. The posterior spinous process of the ilium was cut away and made into small fragments which were placed in the back between the sacrum and the ilium. The wound was closed and a body cast from above the ilium enclosing both legs to the loins was applied. The patient made an uneventful recovery and a little more than three months since the operation is walking nearly normally. The operation was performed before the Clinical Conference of February 23 1917.

I think there are two points in this case which should be especially emphasized. One is the necessity for removing the cartilage from the joint surfaces in order to get bony union. The other is the necessity of immobilizing both legs in a cast to ensure mobility of the pelvis.

### RHINOPLASTY

DR CARL BECK I desire to exhibit a case of rhinoplasty in the intermediate stage in a young man in which I may emphasize the necessity of making our flap long enough in this case to allow for shrinkage and to emphasize the necessity of guarding against haste in carrying out the plastic

### THE PRESENT STATUS OF THE SURGERY OF THE BILE TRACT

DR ARTHUR DEAN BEVAN discussed the subject of the present status of the surgery of the bile tract (See page 40)

### DISCUSSION

DR B W SUPPES Before discussing the paper of Dr Dean I would like to present a specimen which may be of interest to you. The specimen was removed from a case of carcinoma of the papilla which the clinical symptoms were such as to enable us to make a diagnosis before operation. The specimen speaks for itself. You can see the stomach and pylorus the first portion of the duodenum and the papilla sticking out with the carcinoma around it.

It is worth while to bring out in these cases the possibility of secondary cirrhosis of the liver because in the last 4 or 5 years we have had in our service 5 such cases following common bile duct obstruction. We should be more alive to that clinical picture which is not as common now as it was years ago because patients are operated on more regularly. But away back in the French and German literature particularly in the French literature we find a large number of cases of cirrhosis of the liver secondary to common duct obstruction either from stone scar or wound. The effect of damming of bile in the common duct is different in different cases depending perhaps upon the degree of infection that is present and the peculiarities of the individual. In some cases the damming of bile in the liver produces destruction of liver cells from which the patients may die even though the obstruction is relieved to a marked degree.

In one case the patient was jaundiced for only something like seven or eight weeks when death occurred without any apparent cause except the liver destruction. In other cases the damming of bile does not produce any such serious effects. There may be a little development of connective tissue and intermittent obstruction can go on for years without the development of destructive symptoms.

One of the striking things that happens after common duct destruction is that the jaundice disappears. I wonder if that was not one of the reasons in Dr. Bevan's case why reparation of the bile duct was good because there was very little jaundice. After a little while the bile stops secreting biliary ingredients bilirubin and very little bilirubin being produced the jaundice gets less and less. In permanent obstruction after two or three years there is relatively little jaundice even though bile duct obstruction is complete. This woman had only a subicteric hue.

Other things happen in the liver and in various ways. Sometimes there are rapidly destructive changes while at other times there are slightly destructive changes. Bile acids are not produced in the early part of obstructive jaundice. The pulse becomes slow due to the fact that the bile acids are produced and uniting with sodium salts act as toxins to the heart center. Later on with less bile acid and less intoxication the pulse becomes faster.

I would like to call attention to the possibility of cirrhosis of the liver with its further clinical picture of enlarged spleen heart and liver and ascites developing as a result of common duct obstruction. Let us not be fooled into thinking that the common duct is letting bile out when jaundice is reduced but hold in mind the possibility of cirrhosis of the liver developing.

We have had in the last four or five years five cases that were operated on with complete recovery after ascites appeared from common duct obstruction.

DR. E. WYLLIS ANDREWS. One of the principal points the reader of the paper has called attention to

is in line with what I have been thinking about lately in regard to the technique of cholecystectomy and its bearing on the character of dissection of the ducts of the gall bladder. If one should apply the principle of large incisions which has been mentioned to that small strategic point I am coming more and more to think that in the technique of all these operations it would open up the possibility of avoiding all dissection and complications of gall bladder and gall duct surgery. In other words if we apply the principle of large incisions to that little strategic point namely the cystic duct we will not blindly as Dr. Bevan points out put a clamp across the band of tissue which contains the duct and that very variable structure the cystic artery. The more carefully we dissect these structures the more satisfaction we are going to have in our gall bladder work for a number of reasons. If we do this as I saw the reader of the paper do it at the Presbyterian Hospital with blunt dissection with Mayo scissors the first thing we will uncover safely is the large tract of the cystic duct either empty or full. Personally I like to get a strong ligature upon it and use it as a sort of handle. If we mobilize it after we have made the section we put it between clamps or ligatures allowing the gall bladder to become full. We will then have on one hand the stump of the duct and it will not contain the pedicle that has the artery. The artery pedicle will be separate. The practical importance of doing this thing one way more than another is this by properly manipulating the stump and ligating it and dropping it and attaching it to a split tube and following it downward we accomplish a great many things we never thought of before. Dr. Eisendrath has demonstrated this on his models and specimens. Among these things might be mentioned the fact that the cystic duct does not end where we think it does. It does not come to an acute or right angle in the end on the contrary the short piece you have there enters into the broad band which is called the gastrohepatic ligament. It contains three important structures and among them the hepatic artery and the portal vein and follows down that ligament of peritoneum parallel to the end a long distance. If you leave a long tube in that investment you will have too much and you are inviting trouble. I will go a step farther in that and say let us take that little stump which we have and follow it out to its source and not only find where to empty it but open it. Suppose the bile does go into the vessel it is not worth while as a principle in the technique of gall bladder work to make a universal practice of tying open this communicating duct and getting right into the normal common duct as the case may be with probes. Many times we may overlook common duct stones. Every one of us has had the experience in spite of skill in diagnosis of overlooking common duct and hepatic stones and stones left in the ampulla of Vater. Lest this stump of duct magnifies itself until it looks like a big thing it is easy to follow up and dissect and in some of these cases we will be

glad of it because we will find some trouble in the common duct in case we are at the point of closing it.

I have been interested in the last 10 months in the cholesterol content of the blood in its relation to gall stones. We have had 30 old cases in which there seems to have been a constant percentage of increase of cholesterol content in every case which has gall stones. Therefore that feature may have real diagnostic value in predicting the outcome of operations.

DR L. L. McARTHUR. In regard to X-ray pictures of gall stones I agree with Dr. Bevan that the claim of the roentgenologist that 30 to 50 per cent of stones are demonstrable by the X-ray is excessive. Of five cases in the last three or four years that have been turned over to me as gall stones demonstrable by the X-ray in three of them gall stones were not found in the gall bladder. In one of them there was a stone in the kidney, in the other two there were calcareous glands, one with the gland situated at the junction of the cystic with the common duct, which so frequently enlarges with ordinary gall bladder disease with typical calcareous degeneration, and in the other case there were 10 smaller glands retroperitoneal. Jaundice from stone in the cystic duct will occur not infrequently with a very large barrel-shaped stone by mechanical pressure by the end on the common duct in the effort of the gall bladder to empty itself. A large barrel-shaped stone, especially when as big as an ordinary spool, will produce jaundice, and yet there may be none found in the common duct.

The great anxiety I have from a persistent jaundice in common duct obstruction from stone is not from hemorrhage but from anuria, which is almost sure to come on if a straight ether anesthesia is given. This can be largely avoided by giving oxygen anesthesia in such cases. I believe this ought to be done in every case where jaundice has existed for a long time and if it should be given at all it should be administered in the 4 per cent vapor by blowing the gas over ether. The anuria can be avoided if in introducing your tube into the common duct after taking out the stone you insert a small catheter into the duodenum and a large catheter up into the region of the liver, having two drainage tubes coming out of the external wound. You have then complete control of the bile. You have complete control of the stomach if there is nausea or vomiting. You have a means of washing bile out through the kidneys and alimentary tract by using much fluid through the tube which goes through the common duct into the duodenum. I have three such cases in the hospital at the present time with tubes inserted in that way. One of the patients is in a hospital at Lake Forest. He was reported as vomiting seriously. In this case I put two liters of normal salt solution through the tube in the duodenum. The vomitus then tasted a little salty, but the patient was soon in good shape. When you want bile to flow into the duodenum you connect

the two tubes with a piece of glass tubing or eye dropper and bile comes up through the one in the common duct and thence back into the duodenum.

I do not agree with the essayist that when a gall bladder appears normal externally or because by compression it empties itself or when there are no objective evidences of disease of the gall bladder it should be left unopened.

I recently operated on a nurse at the Michael Reese Hospital in whose case I was sorely tempted to remove the gall bladder nevertheless I opened it and found flakes of bile and sand that were evidently making her trouble so by opening the gall bladder and emptying this out it was possible to discover what could not be discovered until I had opened it.

In regard to plastics on the common duct in Surgery Gynecology and Obstetrics for January Ellsworth Elmsley makes a report of 18 cases of plastic on the common duct. Of those 18 cases I have been responsible for four and the correction of a defect in the common duct has in my hands appeared simple and easy. I believe I am the first to have made that form of plastic which is known as the Sullivan duct. I operated before he made any report of his cases, my first operation having been done in 1908. I simply take a piece of rubber tubing of a size which will go into the proximal end of the common duct. At one end of that piece of rubber tubing is turned a double reverse you make thus the end of the tube larger than the new ampulla. If you plan to make that you can be very well assured it will stay a considerable time there then a pursestring is put in that portion of the duodenum which lies some here nearly approximate the tump of the common duct. The duodenum may be mobilized so that it will come in contact with it. The tube is introduced into the duodenum to the extent of 7 or 8 inches for a special purpose, the other end is introduced into the proximal end of the duct and a few stitches put in to narrow it around the cuff that is on the proximal end of the tube. Pushing it down well into the duodenum the pursestring on the duodenum is closed and one or two stitches are used tacking the stump to the duodenum. With that piece in place and another drain down to the line of junction there is no leakage as a rule. After 8 or 10 weeks the tube is passed off by the constant milking of the intestine trying to pass that piece out. There is time enough for the epithelial structure to follow up as it gradually ulcerates its way through the bile in the meantime pass it through it. I believe that much can be accomplished by introducing a large sized tube up and toward the liver and bringing it out through the common duct opening and a smaller catheter (No. 6 or 8 French) passed down through the ampulla. If your patient needs fluids you can give them that way or cathartics without upsetting the stomach and if you on a try it you will like it.

DR DANIEL N. EISENDRATH. I desire to show you a number of lantern slides illustrating some ex-

periments of the effect upon the cystic duct of removing the gall bladder. A preliminary communication of this research work has already been published in the January 1918 number of *SURGERY, GYNECOLOGY AND OBSTETRICS*. These slides will show you quite plainly that the cystic duct dilates after cholecystectomy in dogs more in proportion than in any other bile duct. It reaches its maximum at the end of four weeks and even in dogs killed at intervals of 3 or 4 months there is not much difference in size.

I also desire to show you some slides concerning an anatomical study which has not yet been published. We have secured our material from the Pathological Department of the Cook County Hospital and I desire to thank Dr. Nuzum for permitting us to take these autopsy specimens.

The object of this study is to determine the frequency of the various modes of union of the cystic and hepatic ducts and in 75 specimens thus far obtained we find that our percentages greatly resemble those of Page.

There are three principal types of modes of union: (a) The normal where the cystic and hepatic ducts unite at an acute angle well above the pancreas and duodenum. (b) Where the cystic and hepatic ducts run parallel to each other so that they either unite close to the upper border of the duodenum (short parallel type) or within the substance of the pancreas itself (long parallel type). In the latter some of the slides show where the union occurs almost where the common duct meets the pancreatic duct at the ampulla of Vater. (c) Where the cystic duct winds either around the front or the posterior surface of the hepatic duct and enters the latter upon its left side. We have found the long and short parallel types in 28 per cent of the 75 autopsies and the spiral type in about 5 per cent of the cases.

DR. EVARTS GRAHAM: I would like to say a word in regard to biliary cirrhosis. It is unnecessary to have obstruction either of the common or hepatic duct to get rather extensive biliary cirrhosis.

In some work that I reported at the December meeting of the Society I demonstrated that extensive pericholangitis might extend up into the liver associated with a cholecystitis and in some of the cases in which this was demonstrated extensive cirrhotic changes had taken place without any obstruction whatever to the outflow of bile as evidenced by the clinical picture or anything found at the time of operation.

The course of events in these cases is probably an ascending infection of the nature of a pericholangitis which involves the periportal interlobular tissues

and sometimes extends into the lobules with resulting changes of the parenchyma and substitution of connective tissue.

I had a case recently in which this was demonstrated to a marked extent. The patient giving a gall bladder history extending over a period of fifteen years. There had never been any sign of jaundice present nor the least indication of obstruction to the hepatic or common duct. Yet sections from the liver showed in every field of a low power lens as many as eight or ten lobules whereas normally in a microscopic field with a low power objective you can see only one or two lobules at most. The interlobular tissue was greatly increased in amount and in every field of the microscope could be seen as many as eight or twelve finer branches of the bile duct which were surrounded by dense bands of connective tissue and in some instances three or four times in diameter the thickness of the lumen of the small branch of the bile duct itself. In this instance the gall bladder was removed. A colon-like organism was obtained not only from the hile in the gall bladder but also from the wall of the gall bladder. It was found microscopically lying in clumps in the subepithelial tissue of the gall bladder and was also obtained in culture from a piece of liver removed at the time of operation.

DR. BEVAN (closing): The suggestion made by Dr. Andrews and the specimen shown by Dr. Eisendrath are very important and I would like to again emphasize the importance of following out the cystic duct until we know definitely just what we are dealing with at the time of operation even up to the point—if there is any indication for it—of exposing the common duct.

In regard to Dr. Eisendrath's question as to whether I opened the common duct where there was no evidence demanding it I do not. If I have a definite typical case with stones in the gall bladder and cystic duct and no evidence of stone in the common duct after careful palpation I do not open the common duct. I do not think we should make a routine of opening the common duct in all these cases.

In regard to the reformation of a gall bladder we have had that happen in a case where we had removed the gall bladder and at the end of about 18 months we operated again and removed a gall bladder as large as a thumb that had formed in the stump of the cystic duct. Evidently there is this possibility. In one of the long parallel cystic ducts we have a good deal of cystic duct tissue and if it does become dilated we have quite a good sized gall bladder.

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 21 1917 DR MARK T GOLDSTINE VICE PRESIDENT

### MEMBRANOUS CYSTITIS

DR R A SCOTT The history is that of an adult female age 37. She has had three pregnancies the first 8 years ago the second 6 years ago both of which were normal the third and the one with which we have to deal in this report was finished 18 months ago. Up until the eighth month the urine was normal but a specimen at that time was packed with pus cells and the urine continued to contain a large amount of pus until the pregnancy was finished. There was no time during the ninth month at which the blood pressure was normal, 110 millimeters and the urine was free from cast at all times.

She entered the Newton Hospital in labor at full term March 3, 1909. Her temperature 99, pulse 90, respiration 24. The urine showed a double albuminuria, the number of leukocytes and cultures from urine in the tube culture of pseudodiphtheria. After a night of hard labor the baby was delivered with the application of forceps. There was a postpartum expulsion of the placenta followed by a profuse hemorrhage which was controlled by the use of a uterine tamponade.

The day following I was put in the pertussis room and the physician seen 94 and 40. She complained I've shoot a pain over the bladder in the second day after felt easy to the relief of her condition greatly until he had all the symptoms and finding of a blighted placenta the lower abdomen rigid and tenderness temperature 102 pulse 40 and respirations 32. The white blood cell count was 5000. The head of the bed was elevated and I was given every four hour and fluids were taken in large amounts. The patient's condition improved rapidly and at her own urgent request she was taken home in the ambulance on the fourteenth day after delivery her temperature has been no miller the 24 hours preceding her departure from the hospital. A specimen of urine was examined on that day he left the hospital and thinking that the cystitis was perhaps a part of the general septic condition of the previous two weeks and had not halting me to clear up I prescribed grams of uteroton to be taken every four hours (get) with a large amount of water. At the end of a week the patient again and she complained of frequent painful urination. Her temperature 99 and the urine contained many pus cells and a large number of shreds of tissue. She had difficulty in urinating and voided only a teaspoonful of urine at a time. For the next three weeks I washed out her bladder every second day with a warm saturated boric acid solution allowing

ing the lution to enter the bladder slowly by the gravity method After the bladder was enlarged each day I put in ounces of 4 of 1 pe cent pr targol soluti n and allowed it to remain in the bladder In stead of the cystitis abating, it grew so the shred of tissue passed were larger and passed with a great deal of pain The color of the urine became so offensive that instead of using the boric lotion I used a weak solution of potassium manganate The third day after this the patient had to extract the urine from her catheter before she was able to stop the flow of urine On the fourth day I found the patient in great pain from acute retention of urine which was relieved by the presence in the urethra of rolled fragments of Intermingled with the gray secretion of ed tissue which on next sight I took like mullein herb Her temperature rose pulse was rapid and empiatic very rapid I then ordered strychnine mass of tissue was had purely to the point by the patient but I felt it would not pass a rubber catheter but finally I introduced the catheter to the bladder and relieved it of the distention Not being better I had palpation of the urethra or part of the bladder I call Dr William R Parke He failed to remove the mass and the patient very immediately taken to the hospital and I made to make a suprapubic incision a dream of the mass from below But after this patient was that ed a little relief the illness a removed from the urethra from below the urethra as o delayed by the mass it is that n could lyner the index finger to the bladder The piece of membrane removed by a entimeter The laboretory ed ed as specimen of tissue the her d there th utrin f a blood vessel Culture I o it show l aneity f bacteria with the f cillus cl p dom natu Cultures from the ac at the time have l peculiar together a b cillus

[illegible]

She was able to retain her urine from one half to an hour.

On June 12 1917 15 days after the extraction of the membrane the patient left the hospital in apparently good condition. She had been home for two weeks when she developed a phlebitis in the right leg. This condition cleared up after three weeks of rest in bed.

During the four months that have passed since the attack of phlebitis I have examined monthly a specimen of the urine and have found pus cells in every one but no tissue threads. The last specimen examined November 18 was much better. The patient has gained in weight and her general condition is good but she cannot retain her urine for more than two hours. The bladder at this time according to the patient's statement holds about two thirds of a teacup full.

The patient has refused another cystoscopic examination and any further medical treatment.

The cases thus far reported in this country of membranous cystitis of non diphtheritic origin are comparatively few in number. Rosenow has reported two cases. Curtis one. Townsend one and Nelken of New Orleans one. The German literature of 9 or 10 years ago reported a series of a few cases. Two of the cases mentioned above were adult males and three were adult females.

Rosenow's cases had a sudden onset with chill and fever and frequent painful and bloody urination. Curtis' case had a slow onset having had discomfort for a year before applying for relief. The case of Townsend and Nelken also had slow onsets. In all of these cases blood was a constant finding in the urine as were pus cells and shreds of membrane.

In the case which I have reported the findings just mentioned were present. It has added interest in that it complicated a pregnancy and has run a most severe and protracted course.

#### DISCUSSION

DR T J WATKINS. Relative to the etiology I would like to ask Dr Scott if he concluded that the traumatism of labor was the primary factor. It is possibly not generally understood how much traumatism the bladder may encounter during labor when a knuckle of the bladder becomes engaged between the child's head and the pubes. The case which Dr Curtis reported of pseudodiphtheritic infection of the bladder had calculi and these were probably important etiologic factors. It has been the rule in cases requiring drainage to make a vaginal cystostomy. The modern improved technique of abdominal cystostomy would seem now to be the better operation as better drainage would be obtained and closure by operation would not be necessary. Judging from the results obtained with the Dakin Carrel solution as recently reported by Dr Moynihan of Leeds it would seem to be a most desirable remedy for cases of cystitis with membranous exudates such as Dr Scott reported as the solution mentioned readily cleanses the wound of necrotic tissue.

DR ARTHUR H CURTIS. The case of Dr Rose now's of which Dr Scott spoke was operated on by Dr J Clarence Webster who found membrane adherent to the mucosa of the bladder. Dr Rose now found colon bacilli and some pseudodiphtheria bacilli the latter he thought caused the trouble because they were found in the wall of the bladder and they were agglutinated by the patient's serum whereas the colon bacilli were not. The views of Townsend tend to substantiate the findings which Rosenow obtained. O Neil of Boston reported 56 cases of diphtheritic cystitis and Houltrun worked out 5 cases making a total of 108. The diphtheritic and necrotic cases were not studied bacteriologically. In the few that have been worked up bacteriologically pseudodiphtheria bacilli were present as a basis for the trouble.

#### GLOMERULAR NEPHRITIS WITH SEVERE HÆMORRHIAGE FROM ONE KIDNEY NECESSITATING NEPHRECTOMY

DR W C DANFORTH. The case which I wish to report this evening is that of a man aged 44 married janitor by occupation colored.

I saw him through the courtesy of Dr George F. Barry. He came into the hospital complaining of hematuria on May 12. About February 15 he noticed a very slight staining of blood in the urination. Frequency of urination was not increased at that time nor did it become more frequent as his trouble progressed.

At the time he entered the hospital the urine was bright red in color discoloration showing in every specimen passed. And he was complaining of loss of strength which he had felt for the previous two or three weeks. Up to that time he had worked. He went to bed not because he was wholly unable to work but because of the visible and increasing hemorrhage. No clots had ever been passed. He had complained of pain over the lower abdomen but no other discomfort.

Previous history. He had had the usual diseases of childhood. He sustained a sprain of the right hip a year ago which kept him in bed for six weeks. He denied all venereal infection. He used no alcohol and was moderate in the use of tobacco. The family history was negative. The patient was a large heavily muscled man whose physical findings were wholly negative. Cystoscopic examination of the bladder was negative but upon observation of the left ureteral orifice a puff of blood could be seen coming from it at interval. None was seen from the right side.

Catheterization of the ureters showed that the hemorrhage was entirely confined to the left side. Urinary findings were negative except for large numbers of red cells and the presence of serum albumin which it was assumed came from the large amount of blood.

Examination of a morning sample for tubercle bacilli was negative. After this the entire output of

urine for 24 hours on several occasions was collected and the sediment from the entire amount was stained and examined for tubercle bacilli but none were found. Cultures from the urine obtained from the left kidney by ureteral catheter showed no growth at the end of 4 hours but after several days a lovely growing organism appeared which after several weeks was still growing slowly and had not been fully identified by Dr Gladys Henry Dick, pathologist of the Evanston Hospital.

Repeated X-ray examination showed no stone shadow. The outline however of the left kidney seemed a little larger than normal. Pyelography was not done. Phenol sulphophthalein test showed a total output of 45 per cent for 2 hours. Guinea pigs were inoculated with urine from the left kidney but no tuberculo appeared. His temperature curve during his stay in the hospital of 14 days showed a rise on two occasions to 99 but no other elevation above normal. The pulse remained between 60 and 75.

As tuberculosis could not be demonstrated and as no stone shadow could be found the diagnosis appeared to lie between that of a malignant tumor and a possible variety of the kind described by Hurry Fentick. I was inclined to favor the diagnosis of malignant and he was advised to have the kidney removed.

Preparation terminating upon operation I injected into the pelvis of the bleeding kidney 3 cubic centimeters of a trenaline. The bleeding entirely stopped immediately and did not recur for three days when it gradually began and within two days more was as bad as ever. Sudden stoppage impressed the patient greatly and he demanded that it be repeated. It was explained to him that it would undoubtedly benefit him only temporarily but at his earnest request it was repeated and the hemorrhage stopped again and did not reappear for about a week. During this time the patient went home promising to return if the hemorrhage recurred. In about two weeks he returned expressing himself ready for operation.

Nephrectomy was immediately carried out. The kidney on removal was a little larger than normal but showed practically nothing on cut section except

a little greater congestion than is normal. The specimen was very carefully gone over by Dr Dick for a possible small case of tuberculosis. Sections were made from all parts of the kidney. So many blocks were made for microscopic sections from various parts of the organ that I am unable to show the gross specimen as none remained.

Microscopic sections show the usual degenerative changes incident to a chronic nephritis. In addition the glomeruli show a fibrosis together with an area of albuminous exudate inside the capsule of the glomeruli. An occasional area of degeneration and infiltration with round cells is seen in the parenchyma.

This patient has been seen once recently. He is in excellent health, has gained in weight and is at present actively carrying on his work.

#### DISCUSSION

DR T. J. WATKINS: Did the history or finding indicate any focal infection?

DR W. C. DANFORTH: No focal infection could be demonstrated in the case. The patient was gone over very carefully but nothing was found.

DR ARTHUR H. CURTIS: A patient of Dr Mellinger's whom I saw five or six years ago had unilateral hematuria with symptoms similar to those of Dr Danforth's case. The patient was operated on by Dr Halstead who found what he thought was a varicosity of the veins of the pelvis of the kidney. Jones and McVicker reported eleven cases; they concluded that the chief cause of these hematurias is a nephritis. In 8 cases they bisected the kidney from pole to pole and effected a cure without any further measures.

DR J. CLARE CE WEBSTER: I had 3 cases in the Presbyterian Hospital in which hemorrhage attended the usual treatment as carried out. The first case was reported by Dr Billing. One of the cases was bilateral and the others single. I decapulated the kidneys and there was complete cure in two cases but no change in the third case. I kept track of the cases for two years or so but do not know what the further course was. It is the consensus of opinion of the medical men that decapulation is as the proper treatment.







OLD COMMANDER IN CHIEF

# REPORT OF COMMITTEE ON MEDICINE AND SANITATION, ADVISORY COMMISSION, COUNCIL OF NATIONAL DEFENSE

FRANKLIN MARTIN M D CHAIRMAN

IN reciting the accomplishments of the Committee on Medicine and Sanitation of the Council of National Defense since the organization of the committee in December 1916 it is necessary to summarize briefly the activities of the Committee of American Physicians for Medical Preparedness during the eight months previous to that date. To this body is due much of the credit for the successful results attained by the Committee on Medicine and Sanitation since it was in the earlier organization that many of the plans later prosecuted by the officially authorized governmental agency were initiated.

In April 1916 the Committee of American Physicians for Medical Preparedness was created by the joint action of the presidents of the American Medical Association the American Surgical Association the Congress of American Physicians and Surgeons the Clinical Congress of Surgeons of North America and the American College of Surgeons. To this organization was delegated the duty of formulating plans whereby the civilian medical resources of the United States might be effectively coordinated for such purposes as might be required by the federal government. A chairman secretary and executive committee were selected and state committees consisting of nine leading medical men in each state of the union appointed. To assist the state committees in their work county committees were later organized including in their membership medical representatives of the Army Navy Public Health Service and American Red Cross in addition to other prominent medical men resident in the respective counties.

On April 26 1916 the executive committee of the Committee of American Physicians for Medical Preparedness tendered the services of the organization to the President of the United States. Existing federal laws did not permit the acceptance of gratuitous service by the government and the offer was referred to the Secretary of War and the Secretary of the Navy. Upon the organization of the Advisory Commission of the Council of National Defense on December 6 1916 the committee was requested to continue its activities under the direction of the Committee on Medicine and Sanitation of the Council.

During the spring and summer of 1916 a survey of hospitals and sanatoria had been made by the committee with the result that information was obtained and turned over to the Committee on Medicine and Sanitation upon its appointment concerning the capacity of 1700 of the leading institutions of the country their facilities for caring for military and civilian needs the personnel re-

quired for the successful conduct of the respective institutions and other data of extreme importance.

The Committee on Medicine and Sanitation of the Council of National Defense immediately upon its appointment applied itself to the task of assisting in the expansion of the governmental medical departments to meet possible war needs. As a result when war was declared early in April considerable progress in coordinating the civilian and military medical resources of the country had been made.

## GENERAL MEDICAL BOARD

On April 2 1917 the chairman of the Committee on Medicine and Sanitation was authorized by the Secretary of War to appoint a General Medical Board to assist him in formulating plans for the mobilization of the civilian and military medical resources of the country. The following representative men were appointed to this board:

FRANKLIN MARTIN M D member of advisory commission Council of National Defense chairman  
F F SIMPSON M D chief of medical section Council of National Defense vice chairman  
WILLIAM C GORGAS Surgeon General United States Army  
WILLIAM C BRAISTED Surgeon General United States Navy  
RUPERT BLUE Surgeon General United States Public Health Service  
FREDERIC A BESLEY M D \* professor of surgery Northwestern University Medical School Chicago  
HERMANN M BIGGS M D state commissioner of health New York City  
GEORGE E BREWER M D \* professor of surgery Columbia University New York City  
JOHN YOUNG BROWN M D professor of surgery University of St Louis St Louis  
GEORGE W CRILE M D professor of surgery Western Reserve University Cleveland  
EDWARD P DAVIS M D professor of obstetrics Jefferson Medical College Philadelphia  
JOHN M T FINNEY M D professor of clinical surgery Johns Hopkins University Baltimore  
SIMON FLEXNER M D director Rockefeller Institute for Medical Research New York City  
JOSEPH M FLINT M D \* professor of surgery Yale University New Haven Conn  
THOMAS W HUNTINGTON M D professor of surgery University of California San Francisco  
THEODORE JANEWAY M D professor of medicine Johns Hopkins University Baltimore  
COL JEFFERSON R KEAN director of military relief American Red Cross

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EDWARD C. KIRK, D.D.S., dean of dental department University of Pennsylvania Philadelphia  
 EDWARD MARTIN, M.D., professor of surgery University of Pennsylvania Philadelphia  
 CHARLES H. MAYO, M.D., president American Medical Association Rochester Minn.  
 WILLIAM J. MAYO, M.D., president American College of Surgeons Rochester Minn.  
 STUART McGUIRE, M.D., dean and professor of surgery Medical College of Virginia Richmond  
 CHARLES H. FICK, M.D., professor of surgery Columbia University New York City  
 EARLE PHELPS, sanitary engineer Washington  
 HUBERT A. ROYSTER, M.D., secretary Southern Surgical Association Raleigh N.C.  
 GEORGE H. SIMMONS, M.D., editor Journal of American Medical Association Chicago  
 WINFORD H. SMITH, M.D., superintendent John Hopkin Hospital Baltimore  
 RICHARD F. STRAIN, M.D., professor of clinical medicine Harvard Medical School Boston  
 VICTOR C. VALLEY, M.D., dean of University of Michigan Medical School Ann Arbor Mich.  
 CLORGE WALKER, M.D., chief of surgery John Hopkin University Baltimore  
 WILLIAM H. WELCH, M.D., professor of pathology Johns Hopkins University Baltimore  
 W. C. WOODWARD, M.D., chief of the District of Columbia Washington D.C.

Of the original group made together in 1882 into the military service, the first of them has been found in the list of the members of the board of trustees of the Johns Hopkins Hospital, which are now included in the membership.

JOHN FAIRBAIN, B.Sc., M.D., professor of surgery, Johns Hopkins University Baltimore  
 JOSEPH C. BLISS, M.D., professor of surgery, Johns Hopkins University Baltimore  
 JAMES H. ROLEY, JR., M.D., surgeon in charge, South Baltimore Hospital Baltimore  
 FILLIOTT C. BRACKETT, M.D., professor of orthopedics, Harvard Medical School Boston  
 ALEXIS CARREL, M.D., member of the Rockefeller Institute for Medical Research New York City  
 JOHN C. CLARK, M.D., professor of gynecology, University of Maryland Baltimore  
 FREDERIC J. COTTON, M.D., associate professor, Harvard Medical School Boston  
 ALEXANDER L. CRILE, M.D., secretary, American Medical Association Chicago  
 THOMAS S. CULLEN, M.B., president, Southern Surgical Association Baltimore  
 KATHERINE B. DAVIS, M.D., secretary, Bureau of Social Hygiene Rockefeller Foundation New York City  
 JOHN B. DEVER, M.D., professor of practical surgery, University of Maryland Baltimore  
 ROBERT L. DICKSON, M.D., first vice president, American Gynecological Society Brooklyn

PHILIP SCHUYLER DOANE, M.D., director of health and sanitation, United States Shipping Board Chicago  
 JOSEPH RILUS EASTMAN, M.D., president, American Surgical Association Indianapolis Ind.  
 WILLIAM A. EVANS, M.D., president, American Public Health Association Chicago  
 DUNCAN EWE, SR., M.D., president, Southern Medical Association Nashville Tenn.  
 JOSEPH GOLDTHWAIT, M.D., lecturer on orthopedics, Harvard Medical School Boston  
 S. S. GOLWATER, M.D., superintendent, Mount Sinai Hospital New York City  
 CARY T. GRAYSON, Jr., M.D., chief of United States Navy Washington  
 WILLIAM D. HAGGARD, M.D., professor of surgery, Vanderbilt University Nashville Tenn.  
 S. McC. HAMILL, M.D., professor of pediatrics, University of Pennsylvania Philadelphia  
 H. BART AMY HARRIS, M.D., professor of therapeutics, medical and diagnostic Jefferson Medical College Philadelphia  
 MALCOLM HARRIS, M.D., secretary, board of trustees, American Medical Association Chicago  
 SEALE HARRIS, M.D., professor, Southern Medical Association Birmingham Ala.  
 JEFFREY C. HARRIS, M.D., chairman, Church Hospital Kansas City Mo.  
 HENRY D. JUMP, M.D., chief of pathology, Philadelphia General Hospital Philadelphia  
 CHARLES F. KILLIAN, M.D., professor of surgery, Harvard Medical College Chicago  
 ALLEN B. KANAWER, M.D., associate professor of surgery, Johns Hopkins University Medical School Chicago  
 JOHN H. LANDI, M.D., health commissioner, Cincinnati Ohio  
 JOHN A. LIGHTY, M.D., professor of medicine, University of Pittsburgh Pittsburgh  
 W. H. C. LEA, M.D., D.D., president, National Dental Association Chicago  
 FRED BATE LEE, M.D., surgeon, Harvard Medical School Boston  
 JUDITH M. LEA, M.D., member of staff, Rush Hospital Philadelphia  
 C. JEFF MILLER, M.D., professor of bacteriology, Johns Hopkins University New Orleans  
 ROSALIE SLAUGHTER, M.R.C.O., M.D., chemist, American Women's Hospital New York City  
 MRS. M. ADOLPHUS NUTTING, professor of nursing, Johns Hopkins University College of Nursing Baltimore  
 ALBERT J. OCHS, M.D., professor of surgery, University of Illinois Chicago  
 CHARLES B. PERRY, M.D., professor of gynecology, University of Pennsylvania Philadelphia  
 LEONARD KINROSS, M.D., professor of surgery, Stanford University San Francisco  
 STERLING KUFFIN, M.D., professor of medicine, George Washington University Washington



# COUNCIL OF NATIONAL DEFENSE AND ADVISORY COMMISSION

Seated left right — David F. Houston Secretary of Agriculture Josephus Daniels Secretary of the Navy Newton D. Baker Secretary of War (Chairman of the Council) Franklin B. Lane Secretary of the Interior William B. Wilson Secretary of Labor  
 Standing left to right — Crossland B. Clarkson Secretary of Council and Commission Julius Rosenwald Bernard M. Baruch Daniel Willard Chairman of Commission Franklyn Martin M. D. Hollis Godfrey I. H. D. Howard E. Coffin Walter S. Gifford Director of Council and Commission



MAJ GENERAL W C C  
G IU Army



VICE ADMIRAL W C B  
IU Navy



LIEUTENANT COLONEL B M D  
G IUSPH 115



WILLIAM J M D



IRA M M D



LIEUTENANT COLONEL G L F S M P S O



REAR ADMIRAL A L C  
T C A S N



COLONEL E V T O R C A G



LIEUTENANT COLONEL WILLIAM H WELCH

EXECUTIVE COMMITTEE OF THE GENERAL MEDICAL BOARD

GEORGE E. DE SCHWINITZ M.D. professor of ophthalmology University of Pennsylvania Philadelphia

WILLIAM F. SNOW M.D. professor of public health Stanford University Cal New York City (Secretary General Medical Board)

J. BENTLEY SQUIFF M.D. professor of urology and genito-urinary surgery Columbia University New York City

GEORGE DAVID STEWART M.D. professor of surgery University and Bellevue Hospital Medical College New York City

WILLIAM S. THAYER M.D. \*president Congress of American Physicians and Surgeons Baltimore

WILLIAM B. VAN LENNEN M.D. professor of surgery Hahnemann Medical College Philadelphia

FLORENCE V. WARD M.D. chief surgeon Florence V. Ward Sanatorium San Francisco

RAY L. WILBUR M.D. president Stanford University San Francisco

HUBERT WORK M.D. chairman House of Delegates American Medical Association Pueblo Colo

#### HONORARY MEMBERS

COL. C. U. DERCLE Medical Department French Army Paris France

LIEUT. GEN. THOMAS H. GOODWIN director general British Army Medical Service London England

COL. CLAUDE K. MORGAN British Army Medical Service London England

MR. JULIUS ROSENWALD member of advisory commission Council of National Defense Chicago

At the first meeting of the General Medical Board held on April 9, 1917, the following committees and chairmen were appointed:

Executive — FRANKLIN MARTIN M.D.

States activities and examinations — WILLIAM J. MAYO M.D.

Legislation — VICTOR C. VAUGHAN M.D.

Hygiene and sanitation — SURGEON GENERAL RUPERT BLUE

Research — VICTOR C. VAUGHAN M.D.

Dentistry — EDWARD C. KIRK D.D.S.

Medical schools — JOSEPH M. FLINT M.D.

Publicity — GEORGE H. SIMMONS M.D.

Hospitals — WINFORD H. SMITH M.D.

During the following months new committees were appointed and changes made in the personnel of the original committees as follows:

Child welfare — SAMUEL McC. HAMMILL M.D.

Civilian co-operation in combating venereal diseases — WILLIAM I. SNOW M.D.

Dentistry — W. H. G. LOGAN M.D. D.D.S.

Editorial — EDWARD MARTIN M.D.

Industrial medicine and surgery — JOSEPH SCHIERLSCHWASKY M.D.

Medical advisory boards — EDWARD MARTIN M.D.

Nursing — MISS M. ADLAIFF NUTTING

States activities — EDWARD MARTIN M.D.

Surgery — CHARLES H. MAYO M.D.

Women physicians — ROSALIE SLAUGHTER MORTON M.D.

Volunteer Medical Service Corps — EDWARD P. DAVIS M.D.

#### THE EXECUTIVE COMMITTEE

Such medical problems as develop from the activities of its various committees are considered at the monthly meetings of the board and referred for action if deemed advisable to the executive committee which includes Surgeon General William C. Gorgas, Surgeon General William C. Brusted, Surgeon General Rupert Blue, Rear Admiral Cary T. Grayson, Franklin Martin M.D. chairman, F. F. Simpson M.D. vice chairman, William J. Mayo M.D., Victor C. Vaughan M.D. and William H. Welch M.D. If the recommendations of a committee are approved by the executive committee they are laid before the Advisory Commission or the Council of National Defense or both by the chairman. If endorsed the recommendations for final working out are referred back to the General Medical Board or distributed in the way of information to those in authority in the bureaus concerned.

There is close co-operation between the General Medical Board and the government departments and bureaus which have to do with medicine, surgery and sanitation. At each monthly meeting reports are presented by representatives of the Surgeons General of the Army, Navy and Public Health Service and the Red Cross.

#### ACTIVITIES OF THE GENERAL MEDICAL BOARD

At the first meeting the following recommendations were considered and unanimously approved: the chairman directing the various committees to proceed in accordance with the instructions of the board.

1. Request of the American Red Cross that the legislative committee endeavor to secure through the enactment of proper legislation a place in Washington, D. C. for the storage of medical supplies to be furnished by the American Red Cross to the Army.

2. Survey of available supply of medical men for military and civilian needs.

3. Immediate assignment by the Surgeon General of two medical reserve officers in each state to make personal canvass of their respective states for the purpose of increasing the enrollment of men in the Medical Reserve Corps.

4. Co-operation of the committee on research with the National Research Council in its activities.

5. Conservation of the source of supply of medical men—namely third and fourth year medical students—by recommending that they complete their medical education in order that the government might receive the benefit of their trained services upon graduation.

6 Plan of the committee on dentistry to increase the personnel of the Dental Corps of the Army and Navy and to mobilize the dental facilities of the country for military needs

7 Classification of the staffs of hospital according to availability for immediate military service and institutional needs

Immediately following this meeting the quarters of the committee were enlarged the office force increased and machinery put in motion for carrying out the plans outlined by the General Medical Board. Committee chairman report at the head quarter of the Council of National Defense at regular interval many of them devoting their entire time to governmental activities

Immediately upon the arrival of the British and French commissions in this country in April 1917 the chairman communicated with Mr Balfour and members of the Joffre Commission concerning the need for medical men and supplies in the war zone. As a result of this conference he recommended to the Surgeon General's office that ten base hospitals with personnel sufficient for 1000 beds each and 1000 ambulances be sent to France and attached to the French and British forces. Within a month base hospitals were on the other side in the service of the allies.

On June 11 1917 the executive committee of the General Medical Board appointed a committee to investigate plans for contentment and location of camp site. As a result of this committee's investigation a recommendation was made to the Secretary of War on June 13 that a regulation be made and enforced that the selection of campsites and all plans for the construction of a camp and location of buildings at the supply and general disposal and other matters relating to hygiene and sanitation be submitted to the Surgeon General or his representative for approval before work is started. The Secretary approved the recommendation and the regulation was made.

In addition to frequent committee meetings many sessions of the General Medical Board and group conferences under its auspices have been held most of the last mentioned have been to do with the enrollment of officers for the medical service of the Army and Navy. Some of the new re-

January 6 1917 — Meeting of dean of medical schools to discuss military medical training of students. Attended by 87 representatives.

April 9 1917 to January 3 1918 inclusive — Eleven regular meetings of General Medical Board. Average attendance 50.

April 8 1917 — Meeting of medical schools to discuss continuing of disorganizing medical service. Forty six representatives.

May 12 1917 — Conference with dean of dental examining board to discuss dental activities. Thirty six deans at state examining board attended.

July 18 1917 — Meeting of deans of dental school to discuss enlistment of students in Enlisted Medical Reserve Corps and the assignment to the inactive list. Fifty deans attended.

July 27 1917 — Meeting of homeopathic physicians who agreed to furnish 1000 physician for the Army. Attended by 10 representatives.

August 12 1917 — Special meeting of General Medical Board at Rockefeller Institute for Medical Research New York City. Attended by 46 invited guests and 3 members of General Medical Board.

October 21 1917 — Special meeting of General Medical Board in Chicago during week of meeting of Clinical Congress of Surgeons of North America. Attended by 31 members of General Medical Board and representative of the various state committees.

Week of October 2 1917 — Conference of state committees in Chicago to speed up enrollment in the Medical Reserve Corps. Representatives from 47 states present.

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#### MEDICAL RESERVE CORPS

In the late fall of 1916 the committee was requested by the Surgeon General of the Army to assist that department in arousing the interest of the civilian medical profession in the Medical Reserve Corps with a view to increasing enrollment in the corps to meet possible war needs. The membership of the corps at that time was approximately 1500 including men beyond military age and those who were physically ineligible for active field duty. Through its state and county committee the Committee on Medicine and Sanitation immediately took steps to hasten the medical profession's cooperation in a liability for military service and community need. As a result of this classification 10000 elected men were communicated to the committee urging their prompt enrollment in the Medical Reserve Corps.

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To aid the Navy in securing desirable young men for its Medical Corps a conference of deans of medical schools was called by the chairman in December 1916. To this conference in Washington came representatives of every reputable medical school in the country and the recommendations of the conference — viz. that senior medical students enroll in the Medical Corps of the Navy and that a short course of medical military instruction be included in the curricula of the various institutions — were adopted. Officers of the regular and reserve medical corps were detailed as instructors in military medicine at medical schools and in June 1917 the Medical Department of the Navy was substantially enlarged by the enrollment of the most desirable of the medical graduates of that year.

About 250 000 letters have been sent out of which 143 432 were circular letters of many kinds concerning enrollments in the medical services of the Army and Navy sent to state and county committees and to miscellaneous groups.

Letters were sent to pharmacists, sanitary engineers and ambulance drivers advising them as to where they could be of most service in the Army. Letters were also sent to manufacturers of dental surgical and orthopedic apparatus asking details regarding special qualifications of employees drafted from their plants with a view to utilizing the skill of such men to best advantage in camp or hospital or in factories turning out supplies needed by the government.

In March 1917, fifty medical societies were requested to furnish lists of their members fitted to perform special work for the government.

Early in 1917 many medical men who had returned after service and observation with the allied armies were requested to furnish the committee with information as to conditions in the medical services abroad. This mass of information was carefully summarized and recorded for reference purposes with a view to its possible application to the United States medical services.

#### STANDARDIZATION OF MEDICAL AND SURGICAL SUPPLIES

The Committee on Standardization was authorized February 1917, under the chairmanship of Dr F T Simpson for the purpose of standardizing essential medical and surgical supplies and equipment to increase speed and reduce cost of

production. This committee included in its membership representatives of the Army, Navy, American Red Cross and Public Health Service. Various subcommittees representing the medical specialties and manufacturers were appointed.

Frequent conferences of the committee and its subcommittees were held throughout the spring and summer of 1917 for the purpose of studying by what means production might be speeded up and demand curtailed. With the hearty co-operation of the manufacturers who gave freely of their time and willingly adapted their facilities to the government needs the result has been a substantial increase in the production of staple articles sufficient to meet the enormously increased requirements of the Army and Navy. Four catalogues of staple medical and surgical instruments and supplies were prepared and issued by this committee for the use of the Army, Navy and American Red Cross. Part I Surgical Instruments, Part II Medicines, Antiseptics, Disinfectants, etc., Part III Laboratory Supplies, and Part IV X-ray Apparatus and Supplies.

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The Fuel Administration was informed as to the coal requirements of drug manufacturers. Similarly the Food Administration was advised that many articles coming under its control are required in medicine.

Drug and chemical manufacturers and dealers were informed as to the requirements for licenses in handling explosives or as to the necessity for licenses in exporting substances which are on the conservation list. The removal from the freight embargo list of articles demanding prompt transportation was secured.

#### RECONSTRUCTION OF WOUNDED AND CRIPPLED

On June 2 1917, a conference called by the chairman of the General Medical Board was held to consider the matter of reconstruction of wounded soldiers and sailors and their reeducation for return to civil life upon discharge from the Army and Navy.

As a result of this meeting the Committee on Reeducation and Rehabilitation was appointed. This body met frequently and as a result of its recommendations the chairman of the General Medi-



6 Plan of the committee on dentistry to increase the personnel of the Dental Corps of the Army and Navy and to mobilize the dental facilities of the country for military needs

7 Classification of the staffs of hospitals according to availability for immediate military service and institutional needs

Immediately following this meeting the quarters of the committee were enlarged the office force increased and machinery put in motion for carrying out the plans outlined by the General Medical Board. Committee chairmen report at the head quarters of the Council of National Defense at regular intervals many of them devoting their entire time to governmental activities.

Immediately upon the arrival of the British and French commissions in this country, April 1917 the chairman communicated with Mr. Balfour and member of the Joffre Commission concerning the need for medical men and supplies in the war zone. As a result of this conference he recommended to the Surgeon General's office that ten base hospitals with personnel sufficient for 1,000 beds each and 2,000 ambulances be sent to France and attached to the French and British forces. Within a month base hospital care on the other side in the service of the allies.

On June 11, 1917 the executive committee of the General Medical Board appointed committee to investigate plans for contingents and location of camp sites. As a result of this committee's investigations a recommendation was made to the Secretary of War on June 3 that regulation be made and enforced that the selection of camp sites and all plans for the construction, repair and location of buildings, water supply, drainage, sewage disposal and other matters relating to hygiene and sanitation be submitted to the Surgeon General or his representative for approval before work is started. The Secretary approved the recommendation and the regulation was made.

In addition to frequent committee meetings many sessions of the General Medical Board and group conferences under its auspices have been held most of the last mentioned having to do with enrollment of officers for the medical service of the Army and Navy. Some of these were:

January 6, 1917—Meeting of deans of medical schools to discuss military medical training of students. Attended by 87 representatives.

April 9, 1917 to January 13, 1918 inclusive—Eleven regular meetings of General Medical Board. Average attendance 50.

April 8, 1917—Meeting of deans of medical schools to discuss continuous teaching and danger of disorganizing medical school and civilian hospitals. Forty-six representatives present.

May 2, 1917—Conference of committee on dentistry with deans of dental colleges and dental examining board to discuss coordination of activities. Thirty-six deans and 20 representatives of state examining board attended.

July 18, 1917—Meeting of deans of dental schools to discuss enrollment of students in Enlisted Medical Reserve Corps and the assignment to the inactive list. Fifty deans attended.

July 27, 1917—Meeting of homeopathic physicians who agreed to furnish 1,000 physicians for the Army. Attended by 150 representatives.

August 12, 1917—Special meeting of General Medical Board at Rockefeller Institute for Medical Research, New York City. Attended by 46 invited guests and 3 members of General Medical Board.

October 21, 1917—Special meeting of General Medical Board in Chicago during week of meeting of Chicago Congress of Surgeons of North America. Attended by 31 members of General Medical Board and representatives of the various state committees.

Week of October 22, 1917—Conference of state committees in Chicago to speed up enrollment in the Medical Reserve Corps. Representatives from 47 states present.

March 10, 1918—Special meeting of General Medical Board at Camp Greenleaf, Fort Oglethorpe, Georgia. Attended by 16 members of General Medical Board and about 800 of the doctors in training at Camp Greenleaf.

#### MEDICAL RESERVE CORPS

In the late fall of 1916 the committee was requested by the Surgeon General of the Army to assist that department in arousing the interest of the civilian medical profession in the Medical Reserve Corps with a view to increasing enrollments in the corps to meet possible war needs. The membership of the corps at that time was approximately 1,800 including men of 30 and military age and those who were physically eligible for active field duty. Through its state and county committees the Committee on Medicine and Sanitation immediately took steps to classify the medical profession according to a liability for military service and community needs. A result of this classification 20,000 lectured men were communicated with by the committee urging their participation in the Medical Reserve Corps.

This was supplemented by instruction to the state and county committees to hold frequent patriotic meetings and by personal interview with prospective candidates to concentrate every effort toward securing enrollment. The work of the state and county committees alone has been accompanied by correspondence from the committee in Washington. National state and local medical societies have been requested to devote some portion of the programs of their regular meetings to the needs of the Medical Reserve Corps and the emergency have been addressed by representatives from the Council of National Defense.

In the summer of 1917 60,000 application blanks for enrollment in the Reserve Corps were printed and distributed by the committee to prospective candidates throughout the country. Medical journals were requested to print application blanks

as part of their publications and to give space in their editorial columns to the need for men in the Medical Reserve Corps. Candidates for appointment to the Reserve Corps who were rejected for slight physical defects were requested to have these remedied in order that if necessary they might later be available for military duty.

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In March 1917 fifty medical societies were requested to furnish lists of their members fitted to perform special work for the government.

Early in 1917 many medical men who had returned after service and observation with the allied armies were requested to furnish the committee with information as to conditions in the medical services abroad. This mass of information was carefully summarized and recorded for reference purposes with a view to its possible application to the United States medical services.

#### STANDARDIZATION OF MEDICAL AND SURGICAL SUPPLIES

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production. This committee included in its membership representatives of the Army, Navy, American Red Cross and Public Health Service. Various subcommittees representing the medical specialties and manufacturers were appointed.

Frequent conferences of the committee and its subcommittees were held throughout the spring and summer of 1917 for the purpose of studying by what means production might be speeded up and demand curtailed. With the hearty co-operation of the manufacturers who gave freely of their time and willingly adapted their facilities to the government needs the result has been a substantial increase in the production of staple articles sufficient to meet the enormously increased requirements of the Army and Navy. Four catalogues of staple medical and surgical instruments and supplies were prepared and issued by this committee for the use of the Army, Navy and American Red Cross. Part I Surgical Instruments, Part II Medicines, Antiseptics, Disinfectants, etc., Part III Laboratory Supplies, and Part IV X-ray Apparatus and Supplies.

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This is accomplished by instructing the state and county committee to hold frequent patriotic meetings and by personal interview with prospective candidates to concentrate every effort toward securing enrollments The work of the state and county committee is also greatly facilitated by correspondence from the committee in Washington to National state and local medical societies have been requested to determine position of the programs of their regular meetings the needs of the Medical Reserve Corps and the meeting have been directed by representative from the Council of National Defense

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#### RECONSTRUCTION OF Maimed and Crippled

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As a result of this meeting the Committee on Re-education and Rehabilitation was appointed. This body met frequently and as a result of its recommendations the chairman of the General Medi-

cal Board presented to the Secretary of War a plan for the formation of a reconstruction board upon which would be represented the following departments and interests: United States Army, United States Navy, United States Public Health Service, American Red Cross, Council of National Defense, hospital and laboratory medicine and surgery, vocational education, labor and industry.

The Secretary of War instructed the Surgeon General to call a conference in Washington on January 14, 1918, to which representative of the departments interested were invited for the purpose of formulating a definite plan of action. A bill was drafted which is now before Congress providing for the vocational rehabilitation and return to civil employment of disabled soldiers and sailors.

## REPORTS OF COMMITTEES

### CHILD WELFARE

At a preliminary conference in June 1917 attended by twenty-one representatives of various organizations educational institutions and governmental bureau interested in child welfare the following resolutions were adopted:

We urge the Council of National Defense to ascertain whether there is need among the allied nations for maternity and infant and child welfare work that can properly be performed by American and if this be the case that the council confer with suitable persons or organizations with the view to conducting such service.

Among those who attended this conference were William P. Lucas, M.D., professor of pediatrics in the University of California and Mrs. William Putnam Lovell of Boston, vice president of the American Association for the Study and Prevention of Infant Mortality. Dr. Lucas had been engaged in infant welfare work in Belgium and in August he was appointed head of a group of specialists in child welfare hospital at France under the auspices of the Red Cross, the expedition being financed by Miss Lowell.

Other suggestions developed from this conference led to the formation in the late fall of the committee on child welfare of the Central Medical Board. This committee has prepared and issued to the state through the state councils section and the various committees of the Council of National Defense program concerning the problems of the child in the school age and in preparing program concerning the problems of the child of the school age.

In conjunction with the Committee for Civilian Cooperation in Combating Venereal Disease and the Committee on Industrial Medicine and Surgery it has submitted to the General Medical Board a collection of opinions recommending that the board acknowledge the fact that medical school to have the industrial diseases present in obstetrics and care infant disease and the venereal disease made an integral part of the curriculum of the various medical schools and that members of the faculty and themselves be given opportunity to improve their competence in the problems from the public health standpoint upon the medical profession as well as the public at large.

### It is a subcommittee on

The best graphic methods of teaching child welfare

Food values necessary to children of various ages

### 1. Publicity

Best procedure to recommend to the states in respect to the midwife question in the present war emergency

To consider the advisability of recommending the investigation of institutions for the care of children and the best means of making such investigations

### CIVILIAN COOPERATION IN COMBATING VENEREAL DISEASES

The original committee having this work in hand formulated resolutions and presented arguments at hearing arranged by the chairman of the Committee on Medicine and Sanitation before the Advisory Commission and Council. These hearings resulted in the adoption of the government's policy. The preparatory work included the presentation of arguments before congressmen and committees as to the law against prostitution and alcohol and the original committee also initiated an educational campaign for medical support of the social hygiene program.

The importance of the work quickly led to the appointment of the Subcommittee on Civilian Cooperation in Combating Venereal Diseases as a subsidiary of the Committee on Hygiene and Sanitation. This subcommittee continued the dissemination of literature and continued to develop correspondence. Quarterly circulars "Do Your Bit to Keep Him Fit and Safeguarding Our Soldiers from Venereal Disease" were distributed 28,000 circular letters were sent to selected individuals in nearly 600 communities in the vicinity of Army camps and the active cooperation of about 100 individual offering to serve was established through personal correspondence.

With the enlargement of its activities and with the increasing recognition of its vital importance the subcommittee as made a full committee of the General Medical Board. The committee developed joint conferences of medical and lay interests with officials to discuss plans for venereal diseases clinics.

and law enforcement measures in fifty cities. Advertisers and press association committees were organized for advice and co operation in developing public opinion favorable to the social hygiene program. The governors of all the states were communicated with by wire and letter urging recognition of the emergency and drastic action in dealing with venereal diseases. A list of eight measures essential to a successful campaign was formulated and sent to state boards of health. State pharmaceutical associations and boards of pharmacy were appealed to in an effort to eliminate advertising and sale of venereal disease nostrums. The mayors of 1 000 cities and towns especially in the vicinity of Army camps were also asked to enforce existing laws and enact necessary legislation. Through trips arranged for health officers and qualified officials thirty states were reached and boards of health greatly stimulated to more vigorous work. Volunteer speakers have been furnished in co operation with representatives in civilian communities. Negotiations have been opened with the industrial service sections of the Emergency Fleet Corporation and the Ordnance Department for lectures in shipyards and munitions plants. A syllabus and other data have been furnished the state councils section of the Council of National Defense for lectures to drafted men in county meetings. Editors of health bulletins and labor journals are being kept informed regarding the progress of the campaign against venereal diseases and editorials have been prepared for health medical and social hygiene publications.

Partially as a result of the committee's correspondence with state boards of health throughout the country 32 states have adopted laws or regulations requiring the reporting of venereal diseases. 11 states have organized bureaus or divisions of venereal diseases in their health departments at least 15 states provide free laboratory diagnosis at least 6 states provide arsenphenamin free or at low cost 16 states are engaged in educational work only 2 states have given no indications of activity in venereal disease campaign.

Partially as a result of the letters sent to mayors of 1 000 cities and towns 49 of these cities have made provision for the isolation and treatment of persons infected with venereal diseases. 51 of these cities and towns have measures requiring the reporting of venereal diseases. 43 of these cities and towns have venereal disease clinics or advisory stations. 18 of these cities and towns have educational work under way. 60 additional cities and towns have educational work under way and only 19 cities and towns are classified as complacent.

#### DENTISTRY

At the time the United States declared a state of war to exist between this country and Germany the total number of dental officers was 58—18 captains and 40 first lieutenants—a sufficient

number to care for an organization of fifty odd thousand men. Probably less than 30 of these were stationed in the United States and they were widely scattered. The law at this time only permitted the commissioning of Dental Reserve Corps officers in the grade of first lieutenant and there was not a nucleus of a reserve corps to start with as in the case of the medical service.

In the past year the number of dental officers has increased from 58 in the Dental Corps of the regular army to 99 in the National Guard to 259 and in the Dental Reserve Corps to 5 196—or a sufficient number to supply the quota permitted by law for an army of 5 664 000 men. These officers as a result of the dental law enacted on October 6 1917 are distributed in the same grades and percentages within the grades as are allowed for officers of the Medical Corps of the regular army and National Guard and of the Medical Reserve Corps. The commission of first lieutenant was tendered 5 467 dentists and 95.1 per cent accepted—all but 271.

In the rapid development of the dental service all credit must be given the patriotism of the members of the dental profession the various preliminary dental examining boards dental faculties dental manufacturers and officers and members of the Preparedness League of American Dentists an organization which a year ago had a membership of 5 000 but today has about 15 000 members who have paid the membership fee and declared their willingness to render gratuitous service at least one hour a day when called upon to assist in making dentally fit the selected man after he has been certified to by his local board and previous to his induction into military service.

The official record shows that 166 000 gratuitous dental operations have been performed by the members of this organization. This organization has been largely responsible for the three dental motor car ambulances that have been presented to the Surgeon General of the Army. More efficient dental service is expected to result from the fact that dental inspectors are now regularly visiting the cantonments and camps.

The Committee has co operated closely with the deans of dental schools. At a conference held May 1 1917 attended by deans of thirty six dental colleges and twenty representatives of state examining boards with this committee many details designed to co ordinate dental activities were agreed upon. At another conference July 18 fifty deans discussed with this committee the enlistment of dental students in the Enlisted Medical Reserve Corps and their assignment to the inactive list.

Upon the recommendation of this committee a survey of dental and oral hospital physicians was made. An investigation was initiated as to the relationship of trench mouth disease and oral and general disease. In co operation with dental manufacturers dental instruments and supplies were standardized.

Military instruction was included in the curricula of dental colleges and special training of applicants for enrollment in the Dental Reserve Corps instituted. Improved courses in the Army and Navy medical school for Army and Navy dental surgeons were recommended.

A school of instruction for dental officers started March 1, 1918 at Camp Greenleaf, Fort Oglethorpe, Ga. with Lieut. Col. Snapp, Dental Corps as senior instructor. Eighty-five dental officers and enlisted personnel are assigned each month to take the 10 months course. The first month is given over to 180 hours of general military instruction and training and the second to 70 hours of special military training and 10 hours devoted to professional subjects that have a definite relation to general practice of dentistry as this could be conducted in the Army.

The United States is the only country giving such extensive training in military and professional subjects to dentists and this nation has a greater number of dental officers subject to military call than all other nations combined represented by the term the Allies.

### EDITORIAL

With the idea of being of immediate and direct benefit to the largely increased numbers of medical officers who had not had military medical experience and to enable them the better to conserve the health and lives of the fighting men of the United States, the General Medical Board authorized this committee to proceed with the publication in pocket manual form of textbooks epitomizing the official and practical experience acquired in the war and written by men specially qualified by training and by war experience.

Six Medical and Surgical War Manuals approved by the War Department, the Surgeon General and the Council of National Defense, have been published as follows:

1. Sanitation for Medical Officers by Edward B. Alder, Lieutenant Colonel M. C. U. S. A.
2. Notes for Army Medical Officers by T. H. Cood, in Lieutenant Colonel R. A. M. C.
3. Military Ophthalmic Surgery by Allen Greenwood, Major M. R. C. (E. de Schenitz, Major M. R. C. and Walter R. Parke, Major M. R. C.)
4. Military Orthopedic Surgery by the Orthopedic Council.
5. Lessons from the Enemy by John R. McDill, Major M. R. C.
6. Laboratory Method of the United States Army compiled by the Division of Infectious Diseases and Laboratories, Office of the Surgeon General, United States Army.

In addition to the above list a seventh manual entitled Surgery of the Zone of Advance by George de Tarnowski, Major M. R. C. is now ready for publication.

### HOSPITALS

The committee on hospitals recommended to the general hospitals of the country the reorganization of their staffs in order to release as many as possible of their members for Army and Navy service. Lists were requested of those necessary for the efficient operation of the institutions and lists of those available for service were forwarded to the committee, each person on these latter lists being requested to apply for appointment in the Medical Department of the Army.

The hospitals of the country were classified as to size, convenience to railroad equipment facilities for expansion and equipment for handling special work. Tuberculosis sanatoria and dispensaries were inventoried and a survey made as to hospitals for convalescents. The matter of portable hospitals was gone into and the purchase of a limited number of this form of hospital recommended to the Surgeon General of the Army. Offers of private houses and other large buildings tendered to the Surgeon General for use as military hospitals were classified and tabulated for use by the Surgeon General's office. Hospitals were urged to acquire gradually reserve stocks with a view to future expansion.

### HYGIENE AND SANITATION

Realizing the relation of the alcohol problem to venereal disease, the committee on hygiene and sanitation in April, 1917, recommended to the War and Navy Departments that the zones around camps and cantonments be placed under military control in order to protect the troops from venereal infections and the action of the War and Navy Departments in prohibiting the sale of alcoholic beverages within the camps and erect a cordonment zones was emphatically indicated. A subcommittee on venereal diseases was appointed, which has been of material assistance to the Surgeon General, Office of the Army and to the Commissions on Training Camp Activities. The work of this subcommittee has expanded and it has become the general committee so-called the Committee for Civilian Co-operation in Combating Venereal Diseases. Its activities are detailed under that heading. Its work has been of tremendous importance to the welfare of the Army and Navy and to the civilian population.

The committee on hygiene and sanitation also has subcommittees on drug addiction, alcoholic control, public health nursing, tuberculosis and health statistics. Much valuable information has been assembled and many valuable recommendations as sanitary measures have been made. The subcommittees at all times co-operating with the Army, Navy, Public Health Service, American Red Cross and civilian health agencies.

The committee endorsed the enactment of legislation to establish a reserve corps for the United States Public Health Service.

## INDUSTRIAL MEDICINE AND SURGERY

On January 28 1918 a conference was called by the chairman of the General Medical Board to consider the medical care and sanitation of industrial workers. As a result of this conference the appointment of a committee including in its membership representatives of the Departments of Agriculture Commerce Interior Labor and Public Health Service and of industry manufacturers and the medical profession was recommended. This committee was approved by the Council of National Defense and instructed to proceed with the prosecution of its plan for the medical care of industrial workers. The work of the committee promises to be of signal importance in view of the increased drain on the industrial resources of the country as a result of excessive war time production.

The pressure of production in factories on farms and in mines has produced health problems and social problems which under direction of a government agency must be solved by the medical profession by industry and by labor. The sanitation of industries proper food and housing and the teaching of thrift are war equations. The wage question is relatively in abeyance.

The committee recognizes that the state of war make it imperative (1) to provide against unnecessary human waste in industry and society during the war (2) to offset the drain on industry of man power caused by the raising of military forces (3) to meet the need for greatly increased production (4) to avoid preventable deaths and disabilities from accident and disease (5) to restore to full producing power in the shortest possible time sick and injured workers (6) to increase output by keeping workers in good health (7) to provide healthful places in which to work (8) to provide healthful homes and communities in which to live (9) to meet shortage of medical service induced by military needs.

The Committee on Railway Surgeons has been made a subcommittee of this body and will work in co operation with it. Through questionnaires sent to the railway chief surgeons the railway surgeons were classified as to availability for military duty or necessity for remaining at home.

## LEGISLATION

The Committee on Legislation interested itself at the outset in the safeguarding of the troops from vice in the zone around camps and cantonments. Section 13 of the Army bill was the result. The committee drafted this section in an all day Sunday session in the spring of 1917. It was presented to the executive committee of the General Medical Board on the following day and indorsed. Two days later it was presented to the Council of National Defense and approved and ten days after the first rough draft was made it was enacted into law.

Through this committee the authorities were induced to provide for the enlistment of medical

students of recognized schools in the Enlisted Medical Reserve Corps while allowed to continue their studies. This enactment while not exempting medical students from military service allows them to finish their course before being called. As a result practically every drafted medical student and hospital interne who graduated in 1917 is now in the Enlisted Medical Reserve Corps. Effort is being made to secure a similar provision for pre medical students so that while ultimately they will be called for military medical service they may first be allowed to complete their course.

As soon as war was declared the committee sought to have the Federal Trade Commission provide for the manufacture here of salvarsan and other German owned medicinal preparations. After considerable negotiation license to manufacture these preparations has been given to American concerns. The quantity of salvarsan which a year ago sold at \$4 and higher is now easily obtained American made and furnished to the government at \$1 and in large quantities at a proportionately reduced price.

The committee has made considerable effort to have the rank of medical officers made commensurate with the service which the Nation expects from the profession.

## MEDICAL ADVISORY BOARDS

In November 1917 the Provost Marshal General requested the Council of National Defense to nominate a representative man in each state to serve as medical aide to the governor to advise in the operation of the selective service law. The chairman of the General Medical Board immediately appointed a Committee on Medical Advisory Boards which met in Washington and selected a representative from each state. These representatives were called to Washington to attend a conference and to receive their instructions. The medical aides have been of great assistance to the governors practically all of whom have expressed their gratification at the whole hearted way in which the aides have co operated with them.

A definite plan was formulated by this committee outlining the duties of these aides in the selection of the personnel of medical advisory and local boards and the supervision and organization of all medical activities under the selective service act. Rules of procedure were prepared and approved by the Provost Marshal General.

## MEDICAL SCHOOLS

Immediately upon its appointment in April 1917 the Committee on Medical Schools took steps to survey the medical school situation for the purpose of conserving the future supply of medical men by inducing the students to continue their medical education in order that their trained rather than



untrained services might be at the disposal of the government. Continuous courses canceling the summer vacations for the students were considered but deemed unnecessary up to the present time.

The medical schools were urged to reduce their faculties to a minimum in order that as many teachers as possible might be released for enrollment in the Medical Reserve Corps. The schools furnished the committee lists of those necessary for the successful operation of the institutions.

Through the efforts of this committee third and fourth year students subject to the draft were allowed to enlist in the United States Medical Reserve Corps and placed on inactive duty in order that they might complete their medical education with the understanding that they would apply for commission in the Reserve Corps upon graduation. Medical schools were asked to allow fourth year students to substitute their senior year in basic hospital instead of school if emergency arises.

Letter written to prevent desertion of university students and college asking them to advise premedical students to enroll in the medical schools of their choice as soon as possible.

### NURSING

The Committee on Nursing has made a comprehensive survey of the nursing situation of the country for the benefit of the Army, Navy, Public Health Service and American Red Cross. The committee includes in its personnel the heads of the nursing service of these departments in addition to the leading representatives of the profession on the country. The result of the survey is that the nursing resources of the nation are coordinated in such a way as to be of greatest value to the military medical department.

In addition to instituting a publicity campaign aimed to interest young women in nursing as a career in order that they might upon completion of their training fill institutional positions thereby releasing trained nurses for duty with the fighting forces the committee has made a direct appeal to graduate nurses to enroll in the Army, Navy and Red Cross nursing services.

With these objects in view the committee has sent 2 circular letters aggregating 38,000 to presidents and deans and to 97 graduates of women's and coeducational colleges and universities to secretaries of boards of education to principals of high technical and private schools for girls and to 1017 graduates of the same to superintendents of hospital and superintendents of training school for nurses to state board of nurse examiners nurse registrars and 97 nurse graduates. The letters were designed to appeal to educated young women to enter the field of nursing as a career. A series of a professor on to interest hospital and nursing schools in increasing their capacities and to nurses to find which hospitals could increase capacities to stimulate the enrollment of girls

nurses for military duty and to obtain reliable information concerning the present supply of nurses and of the potential resources now in the training schools of the nation.

Letters of inquiry also have been sent to selected groups asking as to special preparation of nurses for ophthalmological nursing, nurses who have special qualifications, the ratio of students who graduate to those who enter training school and the proportion of alumni who have families dependent on them.

Six leaflets, pamphlets and monographs have been prepared and circulated to these and to thousands of individual inquirers. The total of these editions has been 87,000. They have been designed to create a widespread interest in the nursing profession and to instruct prospective applicants in the choice of training schools and how and where to receive information concerning them.

A three months carefully prepared publicity campaign was conducted under a well known magazine writer and editor and a series of 12 articles on nursing was printed in 19 newspapers published in 39 states and Hawaii.

Early last summer the Committees on Nursing authorized a survey of nursing resources in the United States. While the returns are avowedly incomplete they show definite minimum. No survey was attempted in Arizona or Nevada or New Mexico. These states having no state nurses association. The last returns were received in March. Among the most important statistics supplied are the following:

Graduate nurses	
Registered	66,012
Not registered	17,758
Total graduates	83,770
Graduates in 1918	
From the 150 accredited schools	3,288
From 44 non-accredited schools	1,090
Total graduates in 1918	4,387
Graduate nurses available at the end of 1918	93,600
Student nurses	
In accredited schools	38,938
In non-accredited schools	3,633
Total student nurses in all schools	42,571
NOTE - In statistics of student nurses as given in the list of registered schools by the publication on committee of the American Nurse Association, the number of the above is 553. The number of students in all schools to which the committee last summer sent questionnaires is 1,100. The committee last summer sent questionnaires to 1,100 schools and registered nurses.	

naire to superintendents of 1 500 accredited schools and to 65 professional nurse registries. The first rough analysis of returns from this questionnaire gives the following information—This reply supports the findings of the former ones and shows that schools of nursing are making a remarkably fine response to this appeal for patriotic service. In 1909 schools (representing only half of the schools) there were accepted during the year 1911 3 803 extra students and during the spring of 1918 there will be received 3 19 extra students. This makes a total number of 1 02 additional students admitted up to the end of the spring term. One hundred and thirteen schools state that their obstacles in the way of increasing the number of pupils are due to lack of housing facilities.

The committee is now completing rather extensive plans for a campaign designed to fill the spring classes of every accredited training school of the United States to capacity by June 1st. The co-operation of the section on state councils, the woman's committee and the national association of collegiate alumni is assured. A handbook for speakers is now in press for this purpose.

The committee recommended that accredited training schools giving a three years' course crowd forward the theoretical instruction and hold final examinations and graduation exercises as early as possible in 1918 and release their graduates providing the government needed them and they would enter directly into government service.

The committee has authorized and indirectly prepared the details of an intensive preparatory course in nursing for college graduates to be given at Vassar College during the summer of 1918 this course being open only to women who shall have previously registered with an accredited training school for nurses for entrance in 1918 for an additional two years of regular nurses' training.

The following recommendations with the approval of the Army and Navy Nurse Corps have been addressed to the Surgeon General of the Army through the Executive Committee of the General Medical Board and have been favorably received by the Surgeon General of the Army and the Secretary of War.

That houses be rented and transportation to the nearest town be provided when necessary to accommodate the nurses in lieu of available tents, barracks or other temporary shelter.

That a regular quota of not less than one nurse to six acutely ill men be provided and

That a reserve of not less than 25 over the prescribed quota be stationed at each hospital to meet emergencies and secure special training in the military establishment.

The committee further recommended that a tour of inspection be made by a qualified nurse to make observations regarding the nursing service in the military and naval hospitals in the United States and that this privilege be accorded to Miss Annie Goodrich member of this committee and of the

Red Cross committee on nursing service and president of the American Nurses Association. The Surgeon General has appointed Miss Goodrich inspector general of the nursing service in the United States and France.

The committee has regularly conferred with the Red Cross department of nursing through its director and in December recommended that certain reorganizations of the bureau of nursing be made in order to hasten the enrollment and assignment of nurses that the Red Cross be permitted by the War Department to make temporary assignments of nurses in times of extraordinary need as it does to a civil community in disaster and that the Red Cross undertake an extensive publicity campaign for the enrollment of nurses for military and naval service. All these recommendations have been accepted and acted upon.

The committee has been instrumental in securing the inclusion of nurses in the war risk insurance law and has assisted in gathering data for the War Department's reconstruction program.

The committee has produced evidence to show the need for military rank for nurses and has secured the indorsement of the executive committee of the General Medical Board which has voted to recommend rank for nurses to the Advisory Commission and the Council of National Defense. Some of the members of the committee have recently assisted in the formation of a new committee under the Red Cross composed of nurses and lay women who are endeavoring to secure rank and an increase in the pay and allowances of nurses.

State committees on nursing have been formed under the woman's committees of the state councils of defense in twenty-seven states. Through co-operation with the Committee on States Activities the section on state councils and the woman's committee this committee has exerted a potent influence in checking and in several states over coming a popular demand for short term courses in nursing, while expressing its indorsement of the Red Cross nurses and course if and when the supply of nurses should become inadequate in securing financial aid for hospitals which were willing to increase their classes of nurse students and in conducting carefully worked out programs for increasing the numbers of candidates for nursing education.

#### SUBCOMMITTEE ON PUBLIC HEALTH NURSING

This committee was first of the three committees on nursing now recognized by the Council of National Defense (the others being the general nursing committee and the committee on home nursing of the committee on labor) to establish connections with the Council. At its first meeting it recommended the appointment of the committee on nursing and that a survey of nursing resources be undertaken by the new committee. An informal report was prepared concerning the war's effects on health protection activities in Europe and a letter and que

tionnaire were sent to 130 representative public health nursing agencies seeking similar information and suggestions for action.

The committee secured from the Red Cross bureau of nursing a statement that a special enrollment of all public health nurses exclusively for public health nursing would be granted. Following this assurance this committee sent a letter and a questionnaire to 2500 public health nursing agencies in the United States asking them to indicate the members of the staffs who could be spared. The secretary of the committee has also acted as chairman of a advisory committee to the Red Cross nursing service in the selection of superintendents of public health nursing units.

An experiment in co-operation with the United States Food Administration has been undertaken in two states whereby public health nurses will be given special practical instruction in food economics based on war substitutes which they in turn will transmit to mothers in the homes which they visit. This is to be extended into all the states where public health nursing is engaged.

This committee recommended to the Red Cross nursing service that a superintendent of public health nursing in the extra cantonment zones be urged and recommended that Miss Mary E. Lent, associate secretary of the National Organization for Public Health Nursing be nominated to the Surgeon General of the United States Public Health Service, a qualified candidate for the position. General Blue approved the nomination and appointed Miss Lent a member of his staff.

In co-operation with the National Organization for Public Health Nursing this committee submitted a plan to increase the supply of public health nurses to meet the need in general and the children's year program in particular. This committee has endorsed recommendations regarding the importance of continuing provisions for industrial nurses in connection with the program in behalf of the health housing and general protection of industrial workers.

Four lectures on general diseases have been prepared for distribution to the superintendents of accredited training schools with the request that they be presented to their 1918 classes in order that no graduate may be ignorant of this important subject. The same material is being sent to all public health nurses. The superintendents of training schools are also asked to give the lectures in amplified form to succeeding classes unless the subject of general diseases already receives similar consideration in their curriculum.

### RESEARCH

The Committee on Research has conducted its activities in co-operation with the National Research Council. This committee has been of invaluable assistance to the medical departments of the Army and Navy in investigating through the

laboratories available for its purposes the vast number of medicinal preparations and appliances submitted to the Army and Navy for adoption by private individuals and firms. Every product or appliance receives careful investigation and a report is made to the department interested with recommendations as to its adoption if applicable to military needs or final rejection.

*Utility of canned food.* Early in the organization of the National Research Council it was asked by a national association particularly interested to undertake or to superintend an exhaustive study of the conditions under which canned foods might become and sometimes do become deleterious. The National Research Council referred this matter to the Committee on Medicine and Hygiene. Prof. M. J. Rose, of the Harvard Medical School was induced to undertake the work which has been carried on for more than a year.

*Diet of the great Atlantic.* Up to the entry of the United States into the war this country had depended largely upon German houses for crude drugs and the chemical constituents made from them. For example the United States was using German grown digitalis. Certain universities notably those of Minnesota, Wisconsin and Oregon had for many years their pharmaceutical departments grown small areas of digitalis and other medicinal plants. More fortunately still Professor Rountree of the University of Minnesota had made pharmacological studies of the digitalis grown in connection with the university and had found it to be equal if not superior to German grown plants. The research committee appealed to the university and it responded promptly and patriotically. During the summer of 1917 it grew and harvested about two acres of digitalis at a cost of approximately \$3,000. In addition to this digitalis in Oregon a digitalis was gathered in considerable quantities and all this material has been properly prepared and turned over to the Medical Supply Department of the Army so the supply of digitalis in this country is ample. The American grown digitalis is a different species from that ordinarily grown in Germany and this species has proved pharmacologically to be even better than the German species.

*Dr. B. L. Workman's anti-tetanus serum.* Dr. B. L. Workman, research scientist, one of the most practical and intelligent of the young men in the Rockefeller Institute, assisted by Mr. I. H. Hitt, has worked out and made practical an antitoxin which has been demonstrated to be effective in England and France both for its prophylactic and its curative properties in animals and in man. It is hoped that this antitoxin will rob the gas bacteria of its horrors and will greatly aid in the surgical treatment of infected wounds.

*Epidemic of erythema.* This summer of the Research Committee took up the question of protectors for the epidemic in the noise of battle. Two investigators, Prof. J. Michelson of the Uni-

sity of Chicago and Dr J. Gordon Wilson of Chicago evolved and prepared a hard rubber ear protector and it may be of interest to note that one of these has already done valuable work on injuries to the ear from explosives in hospitals in France and in England.

Later Prof. Stacey Guild of the University of Michigan undertook to test out all known devices for the protection of the ear from injuries due to high explosives and he has published at the request of the National Research Council three valuable papers upon his work which has been tested out and confirmed by representatives of the Surgeon General's office at Indianhead and elsewhere. It may be interesting to state that of all the ear protectors devised up to the present time and tested by Prof. Guild the English Tommy has proved to be the most efficient. This is cheap and can be supplied in quantity. Every soldier can carry any reasonable number and no special skill is required in the application of the protector.

*Study of antiseptics and disinfectants.* The Research Committee is indebted to many chemists, bacteriologists, physiologists and pharmacologists throughout the country for much laborious and time taking study of almost innumerable so called antiseptics and disinfectants presented to the committee. It would require too much space to go into detail concerning these studies. Most of these investigations are indexed and carded and are to be found in the offices of the General Medical Board of the Council of National Defense. The Research Committee proceeded on the ground that in order to silence all criticism every preparation which ever its source should be submitted to examination and its claims tested out in the laboratory and in the hospital. These investigations have been chemical, bacteriological, physiological and clinical and even when the preparation submitted was evidently valueless it was referred to some investigator and tested out in all thoroughness. The information thus obtained has been supplied in every case to the Medical Supply Department of the Army. Some valuable cocaine substitutes have been found and are now in use. Some effective cheap disinfectants have been supplied. Proposed substitutes for salvarsan and other drugs have been tested and proved valueless.

The most valuable contribution along this line lies in the fact that a very large number of absolutely worthless preparations have been appraised at their true value and their vendors in their attempts to sell to the government have been effectually silenced. No one has been able to claim that injustice or partiality has been shown.

*Production of acetone by the fermentation of starch.* In England for some time acetone was largely used in the manufacture of explosives and it was produced by the fermentation of cornstarch. Although an ally, England was bound by a contract with the discoverer of this process so that the United States could not obtain the secret. Prof. Levin of

Rockefeller Institute is now at work on this matter and at last report had obtained quite satisfactory results.

*Dried tetanus as antitoxin.* Rumors came to this country that the Germans were using a preparation of this kind in the treatment of wounds. The Research Committee found that Prof. Robertson of the University of Minnesota had done some work along this line in Germany. Inquiry brought forth a statement that the result of the experiments would justify them in producing a first aid method of administering tetanus antitoxin by drying it on pieces of gauze or cotton and carrying it in this dried condition in the first aid package. It was found that if these dried pads were placed on wounds they would give protection to animals which have received from two to five times the minimum lethal dose of tetanus toxin. The investigator says that while the experiments have not been finished they point to the possibility of considerable reduction in dosage with full and adequate amount of defense provided and that the short time the antitoxin immunity persists renders in a great many cases a second dose necessary in any event and that the smaller doses seem to be fully as efficient as the larger ones.

*Study of hemostatic preparations.* Prof. Lief of Columbia University who at our request undertook this investigation has found that various preparations of thromboplastin are more or less efficient in shortening the period of time for the coagulation of blood.

*Study of shock.* In June 1917 the Research Council made rather extensive preparation for the study of shock and this was placed in the hands of a member of the committee, Dr Crile. However this matter has grown and ramified in so many directions that it is now no longer under the charge of the Research Council.

*Substitutes for ambrine.* About the time America entered the war there was much discussion among clinicians concerning the use of a proprietary preparation used in France in the treatment of burns and known as ambrine. At this time it was practically impossible to obtain ambrine in this country and what little could be obtained sold for a fabulous price. At the request of the committee several men in this country began to search for substitutes for ambrine having first tested and apparently demonstrated the value of this preparation in the treatment of superficial burns. Chemists began attempts to prepare substitutes and this has been worked out satisfactorily.

*Possibility of disinfecting wounds by means of gases.* Various machines and preparations have been submitted for the purpose of sterilizing wounds and meningococcus and other carriers. All of these with possibly one exception have proved without value. The one possible exception is an apparatus for the disinfection of wounds and for the sterilization of carriers by means of a terpezone preparation.

*Sterilization of drinking water* A year ago many claims for processes to be employed by the Army in the sterilization of drinking water were made to the committee. Among these may be mentioned sterilization by ultraviolet rays by ozone by various chemicals and by various forms of apparatus for heating and distillation. The Research Committee asked Professor Phillips of the Hygienic Laboratory and Professor Whipple of Harvard University to prepare a definite statement along this line. These gentlemen recommended chlorination and it is now used everywhere and under all conditions.

*Legislation* Professor Huber of the University of Michigan was asked by the Research Committee to prepare a review of the literature bearing on this subject. This was done in a most complete and satisfactory way and the report has been published.

*Methods of diagnosis* In this respect the committee abstracted and published the literature upon this subject which was obtainable anywhere in France and England. Professor Moore of the University of Minnesota at the request of the committee has taken up this matter experimentally and has made a preliminary report.

*Value of diagnostic tests after treatment for typhoid fever* At the request of the Research Committee Major Rist of the French Army has prepared and published a statement of the results obtained by himself and other French investigators as to the value of the Widal test after treatment for typhoid fever.

### STATES ACTIVITIES

The Committee on States Activities upon its appointment in April 1911 concentrated its efforts primarily on supplementing the act previously initiated by the Committee on Medicine and Sanitation to increase the enrollment of medical men throughout the country in the Medical Reserve Corps.

With the assistance of the state and county committees this committee classified the medical profession according to availability for service in the Medical Reserve Corps and those not available because of home needs. Twenty thousand physicians recommended by the state and county committees for enrollment were written to from Washington and urged to enroll complete details to their professional experience being tabulated card indexed and classified. Certain members of the various state committees were appointed as examiners to tour their states to examine candidates for the Medical Reserve Corps. Monthly tabulations showing comparative percentages of enrollments in the corps in each state are regularly issued and distributed to the state committees with the idea of encouraging competition between the states.

Members of the committee have toured the country for the purpose of arousing interest in the Reserve Corps. More than forty states have been

visited and meetings held in all the largest cities. Special letters have been sent to county committees urging members personally to interview physicians who could be spared to medical graduates of 1914-1917 urging enrollment to local medical societies suggesting methods to protect the practice of physicians called to the service to candidates rejected for slight physical reasons urging adoption of means to correct such defects. Letters of advice to physicians desiring foreign service to physicians who could be spared from hospital staffs urging enrollment and urging physicians who were offered commissions in the Medical Reserve Corps to accept them promptly.

Replies have been made to numerous inquiries from state and county committees medical dental and veterinary school and students and hospital internes with reference to exemption from military service until completion of medical education.

Statistics have been formulated and information secured on which was based the plan for the enlistment of medical students and internes in the Enlisted Medical Reserve Corps placing them on inactive duty until graduation the committee co-operating with the Committee on Legislation in executing this plan.

Representatives of the state committees attended a conference in Chicago in October 1917 on the call of the chairman at which time the many details as to enrollment were planned and the conference did much to stimulate applications for commissions. It was at this meeting that the plan to organize the Volunteer Medical Service Corps was introduced.

The committee has co-operated with the Committee for Civilian Cooperation in Combating Venereal Disease and urged the support of the state committees in those states where legislation and medical assistance was necessary.

This committee is assisting the Committee on Medical Advisory Boards and the central governing board of the Volunteer Medical Service Corps as well as the other committees of the General Medical Board in bringing to the attention of the profession at large activities in which it is desirable to enlist the aid of the general medical public.

### SURGERY

Upon the recommendation of the Committee on Surgery the record of the members of the Medical Reserve Corps were classified according to professional and military qualifications and this information supplemented by confidential information as to ability for certain appointments in the military service. This information has been transferred to code card one et cetera in the offices of the Council of National Defense and two sets being forwarded to the Surgeon General's office one for retention there and the other to be sent to General Pershing's headquarters in France.

The following subcommittees on surgical specialties were appointed:

*Subcommittee on ophthalmology.* This committee immediately upon its appointment in May 1917 proceeded to survey the ophthalmologists of the country for the purpose of requesting those available to enroll in the military service. All ophthalmologists not required for institutional and civil needs were requested to join the Medical Reserve Corps a total of 6 075 letters being sent out. Methods of eye examinations were standardized. A conference on the re education of the blind soldiers was held and a survey made of workshops for the blind. The committee ascertained the number of artificial eyes in stock in the country and investigated the manufacture of glass used in binoculars field glasses and range finders and optical glasses used for aviators and ambulance drivers goggles. Other data of considerable importance were collected by this committee to be used in connection with reconstruction work.

*Subcommittee on otology rhinology and laryngology.* The subcommittee on otology rhinology and laryngology was appointed June 5. The otolaryngologists of the country were surveyed and classified and those available for military duty requested to join the Medical Reserve Corps. Letters to the number of 925 were sent out. This survey included brain oral and plastic surgeons.

The committee aided in revising the requirements as to hearing for entrance to the Army and in the assembling of tests for malingers.

To ascertain the best ear protectors for use in the service tests were made and a report submitted to the Surgeon General who has acted upon it. Special otolaryngological lectures were delivered at the cantonments and the manuscript for a war manual of otolaryngology has been prepared. A carding nistic sheet for use in cantonment base hospitals has been devised. A report regarding the reconstruction of the defects in hearing and speech was made to the Surgeon General's office.

The committee has aided in the standardizing of otolaryngological instruments and participated in the reconsideration of the instrument list with a view to revision enlargement and completion for the base hospitals in camps and cantonments.

On July 9 1917 the two subcommittees mentioned above met together as a Committee on Head Surgery. This joint committee recommended special hospitals for the treatment of eye ear nose and throat cases and prepared plans for a special hospital and dispensary building in cantonments. This committee also recommended that specialists trained along certain lines be assigned to special duty in military hospitals. It further recommended that for each group of several general hospitals there should be a head hospital with one brain surgeon and four assistants one chief ophthalmic surgeon with two assistants one chief nose and throat surgeon and four assistants and that four ophthalmic and six ear nose and throat surgeons be assigned to each division of the mobile forces.

## VOLUNTEER MEDICAL SERVICE CORPS

In order that the services of physicians ineligible for appointment to the Medical Reserve Corps on account of over age (55) physical disability or civil or institutional needs and women physicians might be utilized by the Government the Council of National Defense upon the recommendation of the chairman of the Committee on Medicine and Sanitation authorized and directed the committee to organize the Volunteer Medical Service Corps. A special committee to draft a plan was appointed and on January 13 1918 the plan presented to the General Medical Board was approved. The central governing board in which is vested the general management of the corps was appointed and the machinery has been set in motion to secure members first application blanks being sent to the 5 000 doctors ineligible because of slight physical disability for the Medical Reserve Corps. The central governing board is a committee of the General Medical Board. The state governing boards consist of the state committees medical section Council of National Defense.

The services of members of the corps will be rendered to existing governmental agencies upon the request of the Army Navy Public Health Service and American Red Cross to fill certain needs not already covered and such other services as may be determined by the central governing board of the Volunteer Medical Service Corps.

## WOMEN PHYSICIANS

The Committee of Women Physicians made a comprehensive survey of the women doctors of the country of whom the loose leaf census in the possession of this committee shows there are 5 989 and of these 5 788 are in active practice. The committee has registered 1 916 which is 33.1 per cent. In dorsed lists of anesthetists laboratory workers radiographers and sanitarians have been prepared with the assistance of experts in each line.

Of those who offered their services to the government 803 are listed under the following specialties: administration 58 anesthetics 180 bacteriology 24 chiropody 1 dermatology 1 dietetics 5 electrotherapy 11 eye ear nose and throat 34 gastroenterology 1 general laboratory work 14 genito urinary 1 gynecology 140 hydrotherapy 2 hygiene 13 interpreters 18 kinesiatrics (medical gymnastics) 3 lectures 9 neurology 36 obstetrics 146 orthopedics 13 pathology 18 pediatrics 121 physical examinations 2 psychiatry 59 public health 12 radiography 1 reconstruction 1 research 6 sanitation 36 surgery 196 tuberculosis 14 venereal 3. There are 188 willing to accept contract positions and the 1 113 others stated that their services are available for substitute work in hospitals or private practice service under the Red Cross in industrial plants and for part time service in their home communities.

# MEETING OF STATE COMMITTEES OF MEDICAL SECTION COUNCIL OF NATIONAL DEFENSE WITH STATE ACTIVITIES COMMITTEE AND GENERAL MEDICAL BOARD

THREE hundred physicians and surgeons members of the State and County Committees of the Medical Section of the Council of National Defense representing every State in the Union except one met at the New Willard in Washington on Saturday and Sunday May 4 and 5 called together by Dr Franklin Martin chairman of the General Medical Board of the Council of National Defense.

Attention was focused on two important subjects: Increased enrollment in the Medical Reserve Corps of the Army and Navy and definite plans for the enrollment in the Volunteer Medical Service Corps of those physicians not available for active military service to meet the medical need of the whole Nation.

Plans for the immediate enrollment of 500 additional members of the Medical Reserve Corps of the Army and 500 for the Naval Reserve Force were made by Surgeons General Gorgas and Brister, Member of the State and County Committee, were urged to increase their activities as the authorized governmental agencies for the mobilization of the Nation's medical resources.

## MORNING SESSION

The meeting on Saturday morning was called to order by Dr Franklin Martin, chairman of the General Medical Board who called to the chair Major Edward Martin of Philadelphia, chairman of the State Activities Committee.

The Council of the office was administered to members of the State committees confirming them in their official capacity as the authorized representatives of the Council of National Defense.

In his address of welcome Major F. F. Simpson, vice chairman of the board called attention to the fact that one year previous to the entry of this Nation into the war a national committee on medical preparedness was organized and under its direction the State and County Committees were called into service. These State and County Committees being taken over as a part of the Medical Section of the Council of National Defense upon the organization of that body.

Surgeon General Gorgas spoke of the organization of the Medical Reserve Corps and its expansion during the war until it now includes 20,000 members through the activities of the Medical Section of the Council of National Defense. He pressed his appreciation for the great work already accomplished and in anticipation of its continued activity along the same lines which would insure an ever increasing supply of men for the Reserve Corps. He called attention to the immediate need for 5,000 additional men in the Reserve Corps and stated that he had

just received a pressing call from General Pershing asking that 500 medical men be forwarded immediately to France. If the men will come in now, said General Gorgas, 500 will stand the chance of going to France at once and as there will be numerous requests, nearly everyone can go to France. A few good men must always remain on this side. I am glad to express my gratitude for the assistance you are going to give us in the next two or three months.

Admiral Braisted urged the need of the Medical Reserve Corps of the Navy. Need not quite so large as the Army's but just as necessary. What we need is a gradual constant influx of splendid medical personnel to meet the needs of our service. The work seems greater than it did a year ago. More and more the work is expanding and growing into new fields. We shall need in this new year every bit of help we can get. This great Council of National Defense stands as the leading organization to help us in our work in the war.

Mr. W. S. Gifford, Director of the Council, referred to the legal authorization of the work of the Council that it was to create a relation that would bring about in time of need the immediate concentration and utilization of the resources of the Nation. We have considered that it included the medical resources of the Nation as well as industrial and other resources. In Washington we could have a directing and guiding agency but that the work must be done by the people of the country.

Colonel Caldwell of the Surgeon General's Office presented figures as to the number of medical men in active service in the various corps: Medical Corps 843, Medical Reserve Corps 16,552, Medical Corps National Guard 10, Medical Corps National Army 114. He congratulated the profession upon the fact that this aggregate of medical officers had been contributed to the Medical Department of the Army by purely voluntary effort. It is the desire of the Surgeon General of the Army, in so far as the medical profession will consent to and will volunteer to do to mobilize the medical personnel of the country for the purpose of our military uses. This will best be accomplished by all medical men who are able-bodied who are professionally competent and who can leave their civil activities without sacrificing the activities of the community, industry or cooperation to come into the Reserve Corps voluntarily and accept commissions. If this we do, it would be a simple matter for the Surgeon General to properly officer the military medical forces with competent medical personnel. It would make the task of the Council of National Defense and the different Surgeons General very easy in taking care of the

civil communities wherever they may be in need of competent professional assistance.

The Personnel Division of the Surgeon General's Office has arranged to have at convenient place — has about completed the arrangement in every State of the Union including the Capital — examining boards for applicants for commissions in the Medical Reserve Corps. With this understanding and your efforts when you return home to your activities in the different States the Surgeon General feels confident there will be no question as to the securing of 5,000 additional medical officers for the Reserve Corps in the next few months.

Medical Inspector Murphy explained the need for a large increase in the Navy Medical Corps.

At one time last year we found we had sufficient medical officers for our needs. At the present time despite the forecast we find that we need more and it is hoped that you gentlemen of the State Committees of the Medical Section of the Council of National Defense will help us obtain this additional medical personnel. We need a thousand we calculate for the coming year. It is hoped that we will obtain with your assistance at least 100 a month so as to be safe. I would like to extend to you again on my part as the Surgeon General has already done for himself our appreciation in the Medical Corps of your efforts in our behalf and trust that the future will bring to us your kind assistance once more. At the present time there is a bill before Congress increasing the Navy almost doubling it. We will require more men. All new ships built here and everywhere that no one knows about will need new men. From France we get the request in connection with the American Expeditionary Force from Gen. Pershing that more naval medical officers are needed.

Major John D. McLean spoke on the work of the State Activities Committee referring to the organization of the State Committees a year previous to the entry of this Nation into the war and their inclusion in the Medical Section of the Council of National Defense upon its organization. He reported in detail the service rendered by the Committee to the Surgeons General of the Army, Navy and Public Health in securing desired information as to men available for membership in the Medical Reserve Corps and the enrollment of 5,000 medical officers during the past year. Through this Committee in co-operation with the State Committees has been disseminated a vast amount of information relating to every part of the nation's medical activities in co-operation with the Provost Marshal General's Office it has prepared rules of procedure for the organization of Medical Advisory Boards that has aided in the selection of medical aides for the governors of the several states and formulated plans outlining the specific duties of such medical aides.

This Committee formulated the plans and inaugurated the Volunteer Medical Service Corps as authorized by the Council of National Defense. For membership in the Corps such physicians are

eligible as would be accepted in the Medical Reserve Corps of the Army were it not for physical disability over age, essential public need, essential institutional need or dependents. Women physicians are eligible. The object of the Corps is to establish an emergency medical organization to perform when required such civic and military duties as are not provided for. State governing boards consist of the members of the State Committees of the Medical Section of the Council of National Defense and from this board in each State are selected five men who act as an executive committee to pass upon applications for membership. Upon their recommendation applications are passed to the Central Governing Board in Washington. Each member of the Corps during active membership is entitled to wear the insignia of the Corps as authorized by the Council of National Defense.

The officers of the Corps are as follows: President Dr. Edward P. Davis, Vice President Dr. Henry H. Sherck, Acting Secretary Dr. John D. McLean. The Central Governing Board includes the above named officers: Dr. Edward H. Bradford, Dr. Truman W. Brophy, Dr. Duncan Eve Sr., Dr. William Duffield Robinson, Dr. George David Stewart and ex officio Dr. Franklin Martin and Dr. F. F. Simpson.

Dr. Edward P. Davis of Philadelphia spoke of the purpose of the Volunteer Medical Service Corps.

Would it not be a source of inspiration, gratification and pleasure if we were organized in the service of our Government and if we had something to show for that organization? Those of you who are on Medical Advisory Boards for the selective service enlistment have been doing splendid work which is typical of this class of men. Others of you are teachers in medical colleges. Others are holding position in great city hospitals where their absence would leave the hospital sadly crippled. There are many activities along the lines of executive, educational and institutional work and other things in which we can serve. You may be asked to go to a neighboring camp as consultant. During that work you will be co-operating actively with the Government and you will have an insignia worn in your buttonhole and this will identify you as an officer of the United States Government upon temporary active duty.

Dr. Harry M. Sherman of San Francisco, Dr. H. H. Martin of Savannah, Dr. Charles L. Kahle of Chicago, Dr. J. A. Witherspoon of Nashville, Dr. Rock Sleyster of Waupun, Wis., and Dr. George D. Stewart of New York, told of the progress of the work of the State Committees in their several States.

Dr. Franklin Martin spoke feelingly of the situation in England and France and their great need of doctors and of the work of the American surgeons in the war zone.

In those hospital clearing stations back of the lines our men — men who were in this fight early and were over there first — the best men we have —



are working two shifts from 12 to 1. Do they stop at the end of the shift? No, they work from 12 to 12 and then go on. They sleep three or four hours and then go on again. For a half mile outside of these hospitals men are waiting to be operated upon. They send out the orderlies and tell them to bring in the worst. That is the job over there.

Do you realize that the Government did better than it knew and that Congress probably did better than it knew when it passed the law establishing the Council of National Defense? When war came on fortunately we had a little part in that Council of National Defense. What was our first thin to do? To help the bureau and departments to expand as rapidly as possible in preparing for the coming war and when war came it still further expanded those departments.

You had been working one year before war began under Dr. Simpson and Dr. Mayo. You had worked so well that as soon as the Council of National Defense was organized—at its first meeting—I asked them to take over the organization as the Medical Section of the Council and from that time it became a part of the Council of National Defense. The resolution was passed and at that minute you became just as much Government officers as though you had been receiving salary and had a definite appointment. Do not think that the President does not know everything of importance that happens at each meeting of the General Medical Board and everything of importance that is announced from the activities of the committee. He is deeply interested as I know from conversation with him. He knows the subject from the beginning in April, 1916—a year before the war began—until the day before yesterday and he greets exceedingly that he is not here this morning to say how much he appreciates what you have done for him. He wants you to know that you are the authorized organization to carry on this work in connection with the departments of the Government. I quote from a personal letter:

Thank you for telling me of the approaching meeting of the State Committee of the Medical Section Council of National Defense. Will you not be kind enough to convey to them when they can one message of sincere appreciation from me of their services as authorized governmental agencies to the Army Navy Public Health Service and American Red Cross and of the part they have played in the preparation for war? Will you not at the same time convey to them my warm personal greetings?

In organizing these committees and the original committee that became the General Medical Board we have insisted upon only one thing that any organization anywhere could suggest members to the General Medical Board and if those members were approved by the General Medical Board they would be accepted as individuals and not as members of an outside organization because as soon as they became member of the General Medical

Board and as soon as you became members of the State Committees of the Medical Section you became Government officials.

The one thing we have gotten you here for more than anything else is to change your attitude from that of complacency to that of the man who is at the front and has gotten up his wind for the fight. When you go back home get the members of your committee together and do the work we want you to do as promptly as possible and convey the results to us promptly.

#### AFTERNOON SESSION

DR. EDWARD MARTIN, Chairman. The purpose of this meeting is to justify our existence. At the meeting in Chicago last fall attended so largely by you there was probably more constructive work done than at any medical meeting in this country, and the plan there suggested has been going on steadily every day since. First we wish to formulate a plan by which we may deliver to the Surgeon General of the Army 1000 medical men before the first of July and probably many more within the next year. That does not require much wisdom much time and an absolutely concerted effort on the part of everyone. The first 500 will be easy. The next 1000 will be most difficult. But you men are loathe. It is our feeling that the only way we can get men is man to man from you to them. Your Central Committee met yesterday and laid out a tentative scheme upon which we want your constructive criticism and help. We feel that if we can get together on this matter we can give the Surgeon General the men he needs and the tentative scheme is this: That each State Committee with the help of the County Committee where this seems desirable take their bulleted lists of the profession in their State and select from that list 1000 men. All will be wanted in the first call and notify each one of the men preferably by personal interview by the Chairman or by interview on the part of one of the County Committee men or if not that by letter tell in the first place of the broad general need and in the second place of the immediate pressing and urgent need and in the third place that he has been selected by the State Committee as the man to whom to apply for a commission and object him if to the orders of the Surgeon General. That seems a simple comprehensive way and seems perhaps applicable to this whole country. The problem different in each State and each State must settle it for themselves.

Suppose the man refuses. What is your next step? We will then ask you to send his name to the Committee's office in Washington. He will then receive a direct appeal to enter because you have said he should. Suppose he refuses. We have nothing more to say but we believe that any man who after that refuse to go into the service will find hell a more comfortable place. So you have them. At the first no violence but the kindest

treatment but if needful I have the greatest confidence in the medical profession. We want no such man among us. It is needful that these men should receive certain definite information in regard to the requirements, the cost of equipment, salary, chance of advancement and that has been formulated and will be sent to each one of you. We believe that every man between 21 and 31 should be in the service of the United States. If one of our profession has been taken in the selective service and put on the deferred list because of dependents, that is no impediment where enlistment in the Medical Reserve Corps is concerned. Nor has any man under 31 the right to be so prosperous that he can do much better by himself than the United States can do by him financially. We are after them. Our honor is involved. Our duty is to get them and you will do it.

Thereafter followed a lively discussion of the numerous problems arising out of the work of the State and County Committees. The difficulties that have arisen in certain states with regard to the examination of applicants for the Medical Reserve Corps will be solved by a new plan of the Surgeon General for increasing the number of medical examiners and stationing them at a larger number of convenient points in each state as explained by Colonel Caldwell. The complete details of this plan, including the location and personnel of the examining boards, will be forwarded to the State Committees.

Methods pursued in various states to secure complete data as to available men for active service were explained and discussed as well as methods adopted to secure enrollment. Publicity in the newspapers was suggested as a most effective means. The quota of men desired from each county having been determined by the State Committee, the figures should be published in comparison with the medical population. These facts having been brought to the attention of each community, public opinion will supply the needed influence.

In answer to many questions concerning service in the Medical Reserve Corps, such as rank, pay, special work, etc., the State Activities Committee has had printed a List of Questions and Answers, which is to be distributed through the State and County Committees. Copies of the pamphlet on War Risk Insurance as issued by the Treasury Department may be had on application to the Committee's office in Washington.

In reply to many questions as to the status of a physician under 31 years of age who had not received a commission in the Medical Reserve Corps because of physical disability and afterwards drawn into military service by the local advisory boards, it was pointed out that where such a physician had been sent into a camp and accepted by the surgeon in charge and enlisted as a soldier, he should notify his superior medical officer that he has applied for a commission in the

Medical Reserve Corps. He will then be examined and the Surgeon General will give him a commission even if rejected by the medical examiner, except that he might be rejected on moral grounds. Col. Caldwell of the Surgeon General's office stated that in every instance where a man has been actually enlisted in the army as a private, the Surgeon General will commission him in the Medical Reserve Corps.

Senator Owen of Oklahoma was introduced. It gives me a peculiar pleasure to have the opportunity of paying my respects to you and to your great profession. Nearly all of my people are surgeons and I have always taken a very lively interest in the profession.

In the matter of preserving the lives of the young men we have drawn from the American homes and have sent to defend liberty and righteousness and humanity on the battlefields of Europe, I think it would be impossible for us to take too good care of them. For that reason I have particularly interested myself in having the organization of the Medical Department of the Army and the Medical Reserve Corps given the dignity and rank and position which will enable them to render the service which is required at their hands. In appearing before the subcommittee a day or two ago presenting the argument, I called attention to the fact that the organization of the Medical Department of the Army had by statute one brigadier general who during the life of Gen. Gorgas should be a major general, but when he passes from this terrestrial sphere of usefulness it will be as a brigadier general if the law stands. Under that organization in this war under our present quota of troops under Gen. Gorgas will be 20,000 officers, 50,000 nurses, over 200,000 enlisted men, probably 500,000 beds, allowing one bed to every four soldiers as the peak load as we must be prepared for the maximum and not the minimum. We can not average the casualties of battle but this great force under the present organization of the Medical Department of the Army, omitting what the General Staff might be good enough to recommend to the President of the United States in regard to the Reserve Corps, is one general officer. I presented to the committee the organizations of the medical departments of the French Army, the British Army, the Japanese Army and of all of the armies of the civilized nations of the world, but those three nations I refer to now have in general officers in the medical organization of those armies an average of more than twice as many as I have sought to obtain in the organization of our own Army. Some men are thoughtless enough to think that in asking for these general officers it is a contest of individuals for rank. It is not a contest of individuals for rank. I do not regard the rank of major general as conferring any additional dignity upon Cnle or Mayo. The value of these dignities is to enable the men charged with gigantic responsibilities and preserva-

tion of men the ability to better discharge their functions

I called the attention of the committee to the fact that one civilized nation after another had found it necessary in organizing the medical departments of their armies to give more than twice as many general officers as is sought for in this bill now desired for the better organization of our Medical Department. Will you forget and will the country forget what occurred at Chickamauga under that dear old general officer Brooke the good old American soldier but who had about as much knowledge of typhoid fever as a kamchatkan has of the internal constitution of the ecumenical council? You may remember that one quarter of his entire command had typhoid fever that nearly a thousand picked healthy strong fresh young men died of typhoid fever in that camp. Why? Because the medical officer in charge had no rank because the line officer in charge disregarded the earnest repeated recommendation of the medical officers who were without rank. That is why and the young men died like flies. The medical officers made the right recommendations but the officers of the line could plead an extenuating circumstance that they were entirely ignorant of what would happen if they disregarded the orders. The line officer is left responsible for the health without any moral or ethical responsibility and can not be punished under the organization. If a line officer could be held before a military court martial when men died under his command it would be a far better method of organization.

I want to say to you briefly that I believe now that the committee of Congress have at last understood that this desired organization of the Medical Department of the Army as for the sole purpose of saving the lives of the American soldiers and the responsibility is not in the members of that committee and on the Senate and House. I believe they will discharge their responsibility wisely and well if you give them proper attention.

#### DINNER AT ARMY AND NAVY CLUB

In the evening a dinner was given at the Army and Navy Club for the General Medical Board and member of the State and County Committees. Dr. Franklin Martin being the toastmaster. Dr. Edward P. Davis of Philadelphia responded to the toast. The President our Commander in Chief as follows:

These are stirring days and days of man power. And it is of peculiar significance to citizen of these United States that today the most powerful man in the world is the President of this Republic. And one may easily ask. On what food hath this our Caesar fed that he hath grown so great?

We are men of education and as such to us the development the personality the character of Woodrow Wilson are aside from presidential interest of surpassing importance. He has fed upon education. There was to begin with the

healthy child the brain fibered in faith bred in plain living and high thinking. But this education was peculiar and in no small degree is his present prominence due to that.

He was educated especially by his father and there was a peculiar and most beautiful relationship of the influence of the older upon the growing mind. He has often said that he was allowed to make no statement the accuracy of which he could not demonstrate by reference to a book and in dining with him he has remarked that owing to this habit of his father at the conclusion of a meal in every conversation was had with the children the dining room looked like a book shop for if a child made a statement and the father challenged it if the child could produce a reference proving the statement he stood acquitted. The accuracy of his knowledge which his superior education had dealt with him is due largely to that method of education. His literary style as the constant subject of his father's care and training and the father instilled into this lad the passionate love for the people of these United States. With a desire to know history and state manship and the factors which led to the founding of the country and to its extraordinary growth and coupled with accuracy of knowledge and power of expression came his natural desire to voice his thoughts. The speeches of John Bright were his early study and he has often told me of getting the key to his father's hour upon week days going in and mounting the pulpit and there declaiming John Bright's and other speeches. And are you then surprised that he has taken as his creed of statesmanship the words which Bright expressed the sum of his political idealism.

When hopes fill them to the people

He has elapsed in my friend's path with him for forty years less than any man I know. He has grown by development by accretion of knowledge by strengthening of power but he was in his college days a great demagogue. His friends were the men of mind and heart not of power or place or wealth. It was a dream of him the common sense and nothing human foreign to him to him as the most human of us all in love of humanity. I find him in every thing which pertained to all and added to that the power of reason the gift of expression the utter carelessness of the little things as to whether he stood high or low in the class—leave the matter to him a fellow dear friend.

Then man then by his steady process of evolution demonstrates today the value of education as due to my knowledge of other living men. And is he not to us as educated men an inspiration—not his development I mean—an inspiration for us as are those who may come after us.

There is another side known possibly to you and that is the side of tender affection of him as a dear friend and partner of a noble faith in the one to whom he has given his heart of precious others and thinking little of himself. And it has been

lately a revelation that this schoolmaster this son of a Presbyterian prson this man who was slow possibly at times because he knew more than his critics and saw farther that this man should suddenly develop power And when on the first anniversary of this war he thrilled the world with the statement that this Republic is now in a position where under the guidance of Almighty God it will exercise for the bringing of justice on earth power without limit And the world will find that the blended races of our great country will furnish mettle with which to fight the Hun And one may answer the President as he called for unlimited power —

Strike with the sledge of Justice  
On the anvil of the Lord  
He has heated hot His furnace  
He has opened wide His forge  
He is burning out the dross from men  
With sacrifice and pain  
He has welded there a bar of steel  
That peace may come again  
He has given him the fashioning  
The temper and the edge  
Beat out the sword of righteous wrath  
With Justice fateful sledge

Speeches were made by Surgeon General Gorgas  
Admiral Braisted Major F I Simpson Mr John  
G Bowman Colonel Frank Billings Major W D  
Haggard and Major W W Keen Major Keen  
said

The two finest things I have heard lately are  
first what the President of the United States has  
said we must do We must exercise force *force*  
FORCE to the limit And the second the Secre-  
tary of War has said we must raise men without  
limit

When I think what our brave allies have done  
when I remember that Britain with but 45 000 000  
people has put 6 000 000 men into the army and  
France though we haven't the figures certainly has  
done as well when that splendid British and French  
line with the little help we have been able to give  
have stood with their backs to the wall and have  
resisted the attacks of the Hun I am filled with the  
utmost admiration for what they have done No  
finer an exhibition of bravery of courage of self  
sacrifice has ever been seen [turning to the British

officer present] than your British soldiers have  
made

And where do we stand? We have 10, millions  
or more and if we are to put into the field in pro-  
portion to what Great Britain has done we should  
put in 15 millions and I trust that will be the  
minimum that we will be willing to offer in the  
cause of civilization and of justice

You do not forget I am sure that the name of  
Hun has not been given to the German by us  
In 1900 when the Kaiser sent his troops to China  
during the Boxer rebellion what did he say to his  
troops? Take no prisoners give no quarter he  
more terrible than Attila and his Huns! He gave  
the name of Hun and they have bettered his  
instruction They have not taken prisoners They  
have not given quarter even All the barbarities  
we have heard that have been perpetrated by  
Germany I could not believe at first I had warm  
German friends whom I appreciated and thought  
well of But the evidence to me from personal  
knowledge my friends has been absolutely con-  
vincing and I do not believe there is any atro-  
city that has been told us that has not been true

And what is more they are debasing their own  
people You know today and I know from irre-  
futable testimony that they are debauching their  
own women and that the next generation of Ger-  
mans will be largely a generation of bastards  
Shall we not fight — fight to the death — against  
such barbarities against such cruelties?

There is but one thing for us to do gentlemen  
To answer the President of the United States and  
use force force to the limit Force until we have  
victory And there is one comfort that I always  
have even in the dark days we are passing through  
now I do believe in the existence of God And  
I do not believe that it is in the plan of Divine Provi-  
dence that the whole world shall be ground under  
the heel of the barbarous Hun!

The other day I saw in a circular something  
that impressed me greatly The Inspiration of  
Disaster Think of it! We may come gentlemen  
to the days even now when disaster may come to  
our brave allies and to our own brave boys on the  
other side But the inspiration of disaster will be  
ours and we will swear by the Almighty God that  
nothing shall intervene between us and victory

## ANNUAL MEETING OF GENERAL MEDICAL BOARD

HELD IN WASHINGTON MAY 5 1918

After roll call for members of the General Medical Board the Council oath of office was administered to those present who had not previously taken the oath.

DR FRANKLIN MARTIN chairman This is the annual meeting of the General Medical Board of the Council of National Defense. We have with us as guests members of the State Committees of the Council. Before proceeding with the regular business of the morning I wish to introduce to you a man who is not a physician but who is in the United States Senate and is on the Military Affairs Committee of the Senate, one who has listened to the arguments of some of us in regard to the feasibility of increased rank for medical officers.

SENATOR SUTHERLAND of West Virginia I know that this body is held for business purposes gathered together in connection with the Council of National Defense in order to prepare for entrance into service a larger number of physicians throughout the country. Upon you is laid a very important service. I don't know of any body of men in the country who are sacrificing more for the good of the country than you doctors and surgeons. I have listened with great interest and profit to the discussions before the Senate by your able representatives who have appeared before the Military Affairs Committee including the distinguished gentleman to my left General Gorgas and those who assist him. I have been very much impressed with the justice of the claims of the medical profession for increased rank at the hands of the Government. So far as I am able to do so I will do what I can to secure that recognition. I believe too that the Committee on Military Affairs while I can not speak for them except as an individual yet I believe the feeling as expressed in the committee is favorable to greatly increased recognition.

SURGEON GENERAL GORGAS It is needless to say how extremely gratifying to all of us is the message Senator Sutherland has just given to us. It is probably the most important measure that is now under consideration for the efficiency of the Medical Department. I would like to impress upon Senator Sutherland that the Reserve Corps in war makes up ninety odd per cent of our department and that this bill entirely affects the Reserve Corps. We thank that we have given very good reasons for the bill as it stands and I hope it won't be modified too much.

The Chairman DR FRANKLIN MARTIN before reading his annual report called attention to the fact that while the General Medical Board was not authorized and did not come into existence until April 6 1917 these large groups before me the State Committees have been in existence for two years and the work carried on before April 6 of last year was carried on by practically the same men who afterwards became the members of the General Medical Board.

DR MARTIN detailed the routine procedure with regard to matters brought before the General Medical Board. They are first discussed before the General Medical Board and passed upon at a meeting of the Executive Committee. When a matter has been considered by the Executive Committee it is then a matter of reference first to the Advisory Commission and then to the Council. If the matter is there approved it is sent where it belongs for execution. The General Medical Board has met at least once a month during the year. The Executive Committee meets whenever there is anything of importance to consider.

Reports of committees in abstract are included in the chairman's report to be found in the preceding pages.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## EXPERIENCE WITH FOERSTER'S OPERATION FOR GASTRIC CRISES AND SPASTIC PARALYSIS

By K. KAWAMURA, M.D. AND T. KIMURA, M.D. KYOTO, JAPAN  
Fifth Subdivision of the Fifth Division of the City of Kyoto, Japan

By Foerster's operation we mean the intradural resection of the posterior spinal nerve roots. Although a similar operation was performed for the relief of neuralgia of the brachial plexus by Abbe in 1888 and also by Bennet about the same time rhizotomy for the relief of gastric crises and spastic paralysis was first proposed by Foerster and was successfully carried out by Kuettner in 1908. Since that time the operation has been done frequently and has received the cordial approval of many surgeons while others have doubted its real value. For instance Grigle and Guembel will no longer perform Foerster's operation for Little's disease. Some authors have also found that pain recurs after the rhizotomy for gastric crises so that the nature of the crises has been presumed to be entirely peripheral. These authors claim that relief may be obtained by the extension of celiac plexus. Accordingly it will not be superfluous if we report our recent experience with two cases of the operation and state what we have found to be indications for and results of rhizotomy.

### GASTRIC CRISES

Gastric crises as is well known appear in the earliest stage of tabes dorsalis and is one of its most painful symptoms. Clinically it is indicated by severe pain and vomiting. The pain comes on suddenly and reaches the

height of its severity in an instant. The patient becomes pale, writhes with pain and often falls in collapse. The rapidity of his pulse increasing greatly. The attacks are recurrent and in the meanwhile the patient becomes emaciated and resorts to the use of morphine. Some even attempt suicide. Hence numerous therapeutic measures have been offered such as medical and electrical treatments, epidural and subdural injections of fibrolysine, hydragrum, byodatum, cocaine, stovaine and troprocaine. However if any benefit at all is derived from these drugs it is only temporary.

As stated above, Foerster was the first to propose resecting the posterior dorsal roots for intractable pain in visceral crises. According to Foerster the primary symptom of the gastric crises is due to an irritation of the sensory sympathetic fibers of the stomach which after entering the splanchnic major nerve pass by rami communicantes to the spinal cord through the seventh, eighth and ninth thoracic nerve roots. By the resection of these roots the reflex bow which leads to very painful vomiting is interrupted and the attack of severe pain may be removed. According to our investigation 49 cases of similar operation have hitherto been reported since the publication of his successful case.

The following case of gastric crises came under our care.

## CASE 1 Male laborer 39

*History.* Hereditary tenancy negative. About eleven years ago the patient suffered from chancre and bubo. For some ten years he has complained of acetous eructation, pyrosis, severe pain in the stomach, vomiting. These phenomena had a relation to meals, their frequency and feces variable. In mild attacks sometimes the pains elay away at a minute but at other times obstinate, vomiting and severe pain were experienced. The attacks repeated at least three to eight times daily. Some years an attack continued from fifteen to twenty days in consequence of which his option of food was made absolutely impossible. His patient became thinner and thin. One intravenous injection of alirisan was given but without effect. No benefit as to relief from any treatment. The symptom became more or less with patient became addicted to the use of morphine. Morphine complained for several years of nocturnal furunculosis, discharging from the knee joint.

The patient admitted to our Clinic October 6.

*Examination.* The patient was of medium size, poor general condition, anemic. Although the patient failed him the energy, hearing normal. No difference noted in the color of the two pupils but the pupillary reflex to light was absent. The lungs and the heart normal. No pruritus of the skin of the upper limbs nor any of the abdomen. Effusions were indicated in the inner side of the left thigh, the signs of tubercular exudate, some of the skin of the lower extremity a strongly hyperesthetic to cold heat. The left Achilles tendon reflex reaction both sides. A hyperextension of the left knee (genu recurvatum) was remarkable. The joint was greatly swollen, the circumference of the knee was 54 centimeters, whereas that of the right was 31 centimeters. No pain felt in moving and there was hypermobility in all directions. The x-ray examination showed the products of tubercular process of the articular ends of femur, tubercular hypertrophy of the patella and the iliofemoral space each being the site of a large egg near the greater epiphysis of the femur. The body showed health, the eyes were closed. The examination of gastric juice showed the following result: in the first extraction a total acidity of 13, appearance of free hydrochloric acid and lactacid positive, the second extraction a total acidity of free hydrochloric acid 44 and lactacid positive. It is as yet undetermined if the patient was suffering from tubercular gastritis, though the Wassermann reaction was negative.

*Diagnosis:* Tubercular gastric crises and Charcot's disease.

Because different medical and specific treatments were unsuccessful we decided to do a Forster operation before the patient's life was endangered from excessive emaciation.

*Operation October 26 1916.* A hypodermic injection of pantopon was given one hour before the beginning of the operation and the operation was performed under the influence of ether and chloroform. The patient was placed in the left lateral position. First a mark was made on the skin at the height of the pubic process of the fifth lumbar and a light incision was then made perpendicular to the crease. A longitudinal incision about 0.5 centimeters long was made beginning from the point and extending to the spinous process of the tenth thoracic through the skin over the spinous process. The muscle and peritoneum were loosened partly by sharp partly by dull dissection. After denudation of the thoracic laminae a spinous process of the sixth to tenth dorsal vertebrae were removed. The dura and arachnoid were opened between two small tufts of scalp about 30 cubic centimeters of cerebrospinal fluid flowed out. The tenth posterior dorsal root was isolated from a small spinal nerve accompanying the nerve root and was removed on both sides for 0.5 centimeters. The isolated root was tied off and the dura closed with a continuous very fine silk thread suture. The muscles were sutured in the same manner as in a Lempert intrathecal suture. Then the suture was passed through the fine silk thread through the back and was closed completely without application of either tampon or drainage. At the end of the operation about 6 centimeters of physiological solution were injected hypodermically.

*October 27.* The patient could not sleep at all. History. He is very empty from gastric pain, vomiting. He complained only of a hypermobility of the hip joint and lessened mobility of the hip joint.

*October 28.* The patient felt the lacrimation lessened but there was retention of urine. The temperature 38.

*October 29.* The temperature returned to normal but the retention of urine was unchanged.

*November.* Suture of the skin was removed. The wound had healed completely.

*November.* The patient was not able to control the dribbling from the bladder suffered before the operation. He used to the first time sit upon the bed.

*December.* From the beginning of the relief of the neuralgia the circumference of the thigh increased to a half of palm and the temperature as well as the compensation of the surface of normal skin.

*December.* The renal secretion was very low, somewhat diminished.

*December 9.* The patient has been in good health with no return of gastric pain, adiving during the one year which has elapsed since the operation.

## LITTLE'S DISEASE

Besides the medical treatment there are many surgical procedures for the relief of spastic paralysis. For example multiple

tenotomies and also excision of portions of the contracted muscles have sometimes given good results if followed by careful instruction and the use of retentive apparatus. But for the extreme cases surgical intervention does not prove sufficiently effective.

Toerster first suggested intradural resection of the posterior sacrolumbar nerve roots for spastic paralysis. In his opinion this paralysis consists of a disease of the corticospinal nerve tract and in men it consists essentially of that of pyramidal tract. The motor disturbance which is attributed to this nerve tract is composed of two different components, namely paretic and spastic. The paretic component springs from the interruption of the innervated pyramidal tract fiber and according as the whole or a part of the innervated fiber is destroyed, corticous voluntary irritability of individual groups of muscles is either suspended or weakened. The spastic component consists of the increase of reflex irritability of muscles from periphery. The spastic symptoms arise because the sensory irritations which continue to pour in toward the gray matter of the spinal cord are no longer weakened or destroyed by inhibitory fiber but flow unimpeded into muscles. But if a lesion of the corticospinal tract, namely a disease of lateral column of the spinal cord with spastic paralysis of the leg, is added to a lesion of the path for the conducting of sensory irritation flowing into the lumbar portion of the spinal cord, that is a lesion of the zone of entry of the roots of posterior column of lumbosacral cord, then spastic symptoms will disappear. Thus he has proposed that the severe spastic paralysis of the leg may be cured with the resection of the lumbosacral roots.

#### CASE 2 A peasant boy age 6

**History.** The father died from cancer of the stomach the brothers and sisters of the boy are sound. He was born in the eighth month as one of twins. From birth the child has been very infirm. Three years ago his mother noticed that he kept the knees flexed and crossed. From the very first he has never been able to stand or walk.

**Examination.** The child was small in stature and frail in frame. He had squint eyes. The expression of the countenance was idiotic as a matter of fact he was imbecile. The lungs, the heart and the upper limbs were normal. Both legs were held in adduction

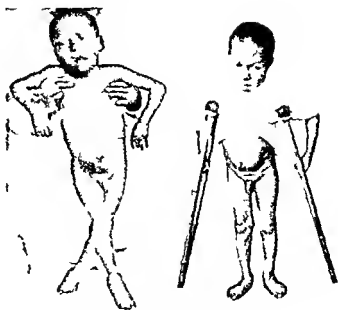


Fig. 1 (at left) Case before operation  
Fig. 2 Same case after operation

and internal rotation so that the lower extremities showed the typical crossed leg progression, each leg being thrown across the other. Both hips and knees were kept flexed. The feet always pointed inward, the right being more extreme than the left (Fig. 1). All active and passive movements were exceedingly restricted. Independent movement of each leg or a part of it was impossible. When we tried to move one of the legs, the movement of the other followed involuntarily. The passive movements of hip, knee and ankle joints provoked a strong resistance which was particularly strong in the ankle joints. The reflexes were exaggerated. Ankle clonus and Babinski's sign were present. He had never been able to walk or even to sit up.

**Operation, March 1, 1921.** The patient was placed in the left lateral position with the pelvis slightly elevated. The operation was performed under the influence of ether. A vertical incision 15 centimeters long was made through the middle of the back, extending from the spinous process of the eleventh thoracic to the upper tip of the sacrum. By the same manipulation as mentioned above the skin, the subcutaneous tissue, the muscles and the psoas were separated. When the spinous processes and the laminae from the first to fifth lumbar vertebrae were removed with a bone forceps and the spinal canal was opened about 50 cubic centimeters of the cerebrospinal fluid flowed. The second, third, fifth lumbar and second sacral sensory roots from each side and also the first sacral nerve root from the right were chosen for resection. They were isolated with a blunt hook and at least a centimeter of each was resected, of course care being taken to avoid cutting small vessels which surround the nerve root. The dura was closed by a continuous suture of very fine silk drawn closely together. The muscles with fascia were sutured in folding and



the skin was treated as usual. Neither tampon nor drainage as applied. The patient's condition at the end of the operation was perfectly satisfactory. On the following day the lower limbs were again absolutely relaxed.

March 3 Healing by first intention took place.

March 4 Passive movement was begun and bath were begun.

March 9 Both legs were fully straightened out at the hips and knees and were bent at a right angle at the ankle joints. The lower limbs were abducted and rotated out and an plaster in this position a plaster of Paris bandage was applied.

April 4 The plaster was removed and electrotherapy was commenced.

May 19 Subcutaneous tenotomy of the left adductor was performed because the adductor spasm appeared more clearly on the left side compared with the right.

May 3 Babinski sign and Achilles reflex appeared but on the left side the knee jerk was still present.

June 9 The patient was able to get up with the help of the upper limbs.

August 4 The patient discharged in good condition at that time. No further neurological nor urinary disturbance was present. No reflex in the sense of touch, sensation. Patellar reflex on both sides normal. The ankle jerk was absent from the right side but the knee jerk was active on it in the left. Babinski sign and Achilles reflex were negative. It was possible for him to stand erect and to take a few steps with the help of the (Fig. 1). Independent active movement of the lower limbs on a part of the day possible. At the time of passing movements were not noticeable.

Now we desire to summarize briefly the chief points in the technique and the results of the operation which we think deserve mention.

The lateral position with the patient on the left side has been found to be very satisfactory. In the prone position calm respiratory movements are disturbed. For example in a case reported by Kuettner respiration ceased in consequence of this position and the patient was turned over upon his back to produce artificial respiration. The patient died later from meningitis owing to entrance of bacteria into the wound. It is well in the operation for gastric crises to place the patient in a strictly horizontal position with the head bent forward as much as possible. If the head of the patient is elevated a large quantity of cerebrospinal fluid flows out during an incision of the dura causing

anxiety lest a critical condition or collapse etc. similar to that reported in a case of Hildebrand should occur. On the other hand in the elevated position of the pelvis though the outflow of fluid is small in quantity, dryness of the spinal cord below the field of operation may occur. Consequently some weakness, pain or paralysis of the leg may be produced after the operation as was experienced by Heile, Becker, Bierend and Hann. In Little's disease it is more effective to lower the head of the bed slightly.

That the outflow of a large quantity of cerebrospinal fluid during the operation is disastrous to the patient is recognized by many surgeons. For example in Lotheissen's case the pulse became extremely weak due to the loss of fluid and even during the operation subcutaneous injection of salt solution was found necessary. It is very difficult to determine how much cerebrospinal fluid may be lost without having any influence upon the patient but according to our own experience the loss of about 30 cubic centimeters of the fluid produces no bad results. Therefore it is not necessary to perform extradural resection of the posterior roots as was attempted by Guleke.

The operation has been performed by some surgeons in one stage and by others in two stages. First the removal of the spinous processes with the laminæ and after a few days the opening of the dura with resection of the posterior root. Which is to be preferred? Hietze has performed in two stages a similar operation upon five cases suffering from gastric crises and neuralgia and he claims that its strong points are: There is clear vision of the field of operation as there is no excessive hemorrhage at the time of the opening of the dura and therefore there is no necessity of wiping frequently and there is no injury to the nerve roots. Others believe that it minimizes shock which is supposed to be especially great in this operation. According to our own experience however the shock and the bleeding are not so great as they were formerly supposed to be. Besides in the two stage operation the danger of wound infection is increased and the risk due to the anæsthetic is doubled. Therefore we

do not advocate the performing of the operation in two stages. We believe that it is better to perform the whole operation in one stage except when the condition of the patient is such as to allow an operation extending over so many hours.

In regard to the suture of the wound many surgeons employ the interrupted suture using fine catgut or silk-worm gut for closing the dura. We have applied a continuous suture with very fine silk-worm gut instead and have thus prevented the leakage of cerebrospinal fluid. For the elimination of the dead space which is formed by the resection of spinous processes and laminae we have sutured infolding the muscles as is done in the Lembert intestinal suture. After closing the wound completely the patient is placed in the dorsal position. Because the dead space is very large it seems that the application of a tampon or drainage is necessary. But the danger of introducing bacteria is not only much increased but the cerebrospinal fluid sometimes flows out after their removal. Floorcken reports a case in which he applied a comparatively close suture on the dura but after the removal of the drain a large quantity of fluid accumulated under the wound and readily cured. Lotheissen says that in his first case he inserted iodoform gauze in the wound for the arrest of hemorrhage and saw an outflow of cerebrospinal fluid at the time of its removal a few days later. Three days after that the patient suddenly suffered with a high fever and his consciousness was disturbed. Hildebrand and Tietze have described a similar experience. Being warned by these cases we have sutured the wound with no drain and have obtained good results.

In Foerster's operation the spinal roots should be resected for cutting them is not sufficient. If they are not resected there is anxiety for fear that a relapse may occur. Chipault has estimated that 1 centimeter at the cervical segment, 2 centimeters at the dorsal part and 3 centimeters at the lumbar region can be resected. We resected in our first case 0.7 to 1 centimeter from each posterior root and at least 1 centimeter in the second case. Although Guleke finds no necessity for resection of posterior nerve roots we can

not entirely approve of that method. This opinion seems to be substantiated by Abbe's case of neuralgia of the brachial plexus in which a relapse occurred after cutting the posterior roots but when the roots were resected it brought a happy result.

How many nerve roots are to be cut? At first Foerster suggested cutting from the seventh to the ninth dorsal roots in a case of gastric crises but in a further report he recommends that five, six or even seven roots be cut as the sympathetic nerve fibers originating in the stomach and intestines reach from the sixth to the twelfth. The resection is generally performed from the seventh to the tenth dorsal roots and occasionally from the seventh to the ninth and still less frequently in other cases. In our first case we chose to resect from the sixth to the tenth roots. In Little's disease Kotzenberg resected from each side the third and fifth lumbar and the first sacral roots in a case of extreme spasm and marked paralysis and obtained complete success. In accordance with the proposition of Foerster we have resected more extensively, selecting the second, third, fifth lumbar and the second sacral roots on both sides and also the first sacral root on the right. In spite of this however there was a slight resistance when the left leg was moved passively. In view of these facts it seems to be advisable in a case of an extreme spastic condition of Little's disease to excise at least four roots on each side.

Because the patient with gastric crises is generally speaking debilitated from the disease and the use of morphine the degree of danger of a Foerster operation is often far greater than would be the case in doing the same operation for Little's disease or neuralgia. According to the statistics of Lotheissen 9 cases of different forms of neuralgia have been operated on and of these the results were not good in 6. However if we subtract 3 cases which died from causes not due to the operation the mortality is 10.3 per cent. On the other hand if the 3 cases which died of tuberculosis or other unknown causes are subtracted from the 29 cases operated upon for gastric crises there are 9 cases or 31 per cent in which death is attributed to the operation. If we

deduct the cases of pneumonia and pulmonary embolism which may follow operations for other diseases the percentage will become 17.9 per cent. From the time of Lotheissen's report up to the present 11 cases of a similar operation have been published including our first case. Of the eleven cases none died as the result of the operation and if we add the above number to the statistics of Lotheissen the mortality for the operation of gastric crises is barely 14 per cent. Under these circumstances the danger is by no means startling.

On the whole Forster's operation is so successful that it has been repeated with satisfactory results a number of times since. The results immediately after the operation are especially remarkable. Kuttner's first patient suffering with gastric crises ordered his own meals from the day following the operation and his weight increased 4 kilograms during the first week. A patient of Bruns and Sauerbruch gained 22.5 kilogram in weight within six weeks. In our first case vomiting and pain stopped entirely from the day follow-

ing the operation and with a normal appetite of a healthy person the patient gained in weight daily. The results of our second case were also successful. A boy who could not stand up at all before the operation walked fairly well with crutches and especially well when led by the hand. But at times after the rhizotomy paraplegia occurred which later disappeared partially although not completely. As its causes the following technical failure are enumerated: harsh treatment of the spinal cord; injury of small arteries resulting in hemorrhage into dural sac and disturbance of nutrition of the cord; excessive decubation of the cord on a count of a long continued depression of the head with elevated pelvis.

Therefore if we are to give a final decision as to the results of the operation it is necessary to observe the patient for a long time after ward. In Little's disease the after treatment of the patient is of supreme importance. The use of the plaster of Paris bandage with its covering easily removable suitable exercise massage electrotherapy etc. should be continued for sometime.

OESOPHAGEAL DIVERTICULA<sup>1</sup>

BY J. S. JUDD, M.D., F.A.C.S., ROCHESTER, MINNESOTA

**D**ILATATIONS of the entire oesophagus are usually produced by spasmodic contractions at the lower end while dilatations involving only a segment of the organ are either congenital or situated above a stricture. These dilatations differ entirely from diverticula in that the former involve all of the structures of the oesophagus while the diverticula are in reality only hernias involving the mucous membrane and submucosa which project through the muscular coats.

The diverticula are divided into two types traction and pressure diverticula. In traction diverticula the distortion is usually due to a pulling force acting from outside the oesophagus and generally occurs at the point where the oesophagus crosses the left bronchus. It is most often due to the contraction of a cicatrix formed by the healing of a suppurating lymph gland. Diseases in the pleura or lung adhesions to the thyroid when there is a marked cystic degeneration mediastinitis and crises of the vertebrae have all been cited as etiologic factors in producing this form of diverticulum. It has also been noted that these diverticula are often multiple. In 1900 Brosch called attention to the cavum broncho-aorticum stating that the aorta bending to the left and backward crosses the oesophagus on its left side forming between the aorta and the left bronchus this narrow space where the oesophagus is not in contact with any firm structure as is the case in other regions. As food pressing down the oesophagus is presumably under more or less pressure from the surrounding firm structures there is an opportunity for pouching on its arrival at this point where outside pressure is lacking and internal pressure predominates. LeCount has observed three of these diverticula which were unattached either to lymph nodes or to any surrounding structure. As no microscopic examinations were made of the sacs in these cases it is uncertain how many of the oesophageal coats were involved. According to the location size and other characteristics

these cases might have been classified as traction diverticula but for the fact that there was no pulling from the outside.

Traction diverticula usually produce no symptoms and are of no surgical importance. It is said that the apex of the diverticulum is usually higher than the base so that no food or mucus can accumulate in it. However in some cases the apex has been low enough to allow an accumulation of food particles and these cases are known as traction pulsion diverticula which sometimes attain to considerable size. Even then they seldom present symptoms. We have seen one case in which there was a fairly large sac at the lower end of the oesophagus which apparently produced few if any symptoms (Fig. 14 Case 197786).

The findings were as follows:

CASE 197786 W. T. W. a male aged 42 years consulted us July 14, 1917 at which time he gave a history of stomach trouble of twenty years duration. He complained chiefly of a feeling of fullness coming on in spells periodically. There had been no regurgitation of food or sense of obstruction during this period. He had been treated elsewhere for stomach trouble for fifteen years. Five years previously he had vomited a large quantity of dark blood and since that time there had been considerable regurgitation of acid food and mucus. His condition gradually grew worse up to the time of our examination. Two years previous to this he had had an X-ray examination of the oesophagus and stomach elsewhere with a negative diagnosis at this time he had had two nocturnal attacks of epilepsy and later two other attacks. Physical examination showed a fairly well nourished man weighing 183 pounds. The Wassermann test was negative. The X-ray examination of the stomach was negative but revealed a diverticulum of the lower third of the oesophagus which confirmed the opinion that had been given.

Tetens found that of 80 traction diverticula 6 had assumed the characteristics of the traction pressure variety from the accumulation of food and inside pressure.

The pulsion or pressure diverticulum is a particularly interesting condition and the treatment shows marked development in this kind of surgery in a comparatively few

years Zenker and Ziemssen in 187 described such diverticula and their description of the occurrence and pathology is the basis for all of our present knowledge concerning them. They stated that radical cure of a diverticulum of the esophagus by operative procedure from without was one of our wishes but they hoped that even this operation might at some future day be performed safely. At the present time the condition can be readily and accurately diagnosed and is amenable to surgical treatment. Such diverticula are always located in the cervical region in the unsupported esophageal wall at a point directly opposite the cricoid cartilage. This is a weak point in the arrangement of the musculature at the juncture of the pharynx with the esophagus and is sometimes spoken of as the pharyngeal dimple. There is a physiologic narrowing at the level of the constrictor muscle and a hiatus exists in the longitudinal muscle. In all of our cases the opening has been posterior and the sac has usually projected itself to the left side. Just what the etiologic factor in the epi-esophageal diverticula is has never been definitely shown but it has been shown that the pressure in the esophagus is greatly increased during deglutition. Harsh has demonstrated that deglutition, buccal pharyngeal and esophageal and that food are carried down the esophagus by peristaltic contraction. He has also demonstrated that it is necessary for the upper cricoid to be closed in order to allow the content of the esophagus to enter the stomach otherwise there is regurgitation. It is very likely that this pressure is greater if the food is not properly masticated and is swallowed too rapidly. It is quite possible that any unusual increase in pressure may account for the formation of some diverticula.

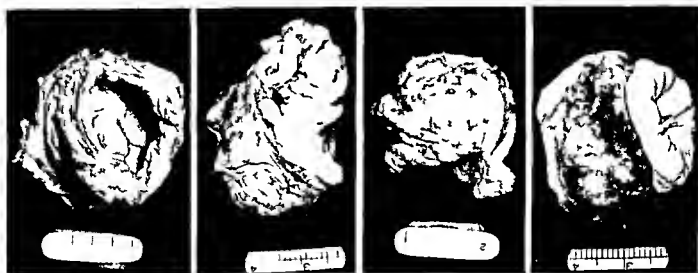
About 150 pre-esophageal diverticula have been reported in the literature. Several years ago Stetson collected 60 cases in which operation had been done with a mortality of 16.6 per cent. There are thirty-five cases in the series discussed in this paper.

The first symptoms of this condition are usually dryness in the throat and a crutchy feeling as though there were a small foreign body present. These sensations make it

difficult for the person to swallow. Nauzea follows, mucus is raised from the throat and later particles of undigested food are brought up. Difficulty in swallowing was noted in all of our cases while 30 out of the 35 patients complained of regurgitation of food. A gurgling noise in the throat which is often mentioned was present in 1 of the cases. A feeling of pressure symptoms of stricture and choking sensations develop. The symptoms of an esophageal diverticulum rarely present themselves before patients are 45 years of age. The average age in our 35 patients when they came for treatment was 54 years. The average duration of symptoms was  $5\frac{1}{2}$  years. A visible or palpable tumor of the neck occurs only when the sac is large and in the cases formerly reported this occurred in about 50 per cent. Ten of the patients of our series had a visible or palpable tumor in the neck. In 7 cases the tumor was on the left in 3 on the right side. The weight loss is great in case the sac is large or so shaped as to close off the lumen of the esophagus. In some of the cases the obstruction was almost complete. The average loss of weight in the entire series was 7 pounds, the highest being 65 pounds. In 8 cases in which the diverticulum was small there was no loss in weight. Some of these patients learn to feed themselves with a stomach tube when the swallowing becomes too difficult. In some of the extremely emaciated patients it seemed best to perform a gastrostomy before attempting any treatment of the diverticulum although feeding can usually be kept up with a small tube. I think preliminary gastrostomy is seldom if ever necessary.

The size of the neck of the diverticulum varies greatly. The opening into the esophagus may be small producing a typical saccular diverticulum but in some of our cases the opening was as large as the lumen of the esophagus. It is well to bear in mind that in a certain number of the cases the opening of the diverticulum is large because in removing them too much of the wall of the esophagus is removed (Fig. 12).

The diagnosis can practically always be made by means of an X-ray picture taken after swallowing a bismuth mixture. The X-ray and the esophagoscope make the



E (11623)

I (194431)

1 (13906)

F (18360)

Photograph of diverticula showing the character of the wall

diagnosis certain. The history nearly always gives a good clue to the diagnosis and this together with a physical examination and the presence of the characteristic swelling in the neck is sufficient. Before the use of the modern methods of examination many of these cases were diagnosed as cardiospasm, oesophageal stricture and carcinoma. In many instances gastrostomy has been performed for oesophageal diverticulum on the assumption that the obstruction was caused by malignancy.

The treatment of oesophageal diverticula is surgical and should be made as conservative as possible. It consists in either obliterating or removing the sac. Several different methods having been devised for this purpose. In the extreme cases it is always necessary to put the patients into as good general condition as possible before attempting any treatment for the diverticula. Instead of performing a preliminary gastrostomy, as has been suggested in the emaciated and starved cases, the same object can often be accomplished by rectal feeding, subcutaneous salines and feeding with a stomach tube when that is possible. The majority of our patients came for treatment in a sufficiently satisfactory general condition to warrant doing the operation on the diverticulum without any preliminary measures.

When the diverticulum is small and has a

large opening communicating with the oesophagus dilatation with large sounds will in some instances relieve all the symptoms while in others this method of treatment may be preferable to the more radical excision especially if there is any contraindication to the open operation. Mixer has satisfactorily treated a number of patients in this way, however it might be necessary to repeat this treatment from time to time.

Bevan recently described a method of infolding the diverticulum by means of a series

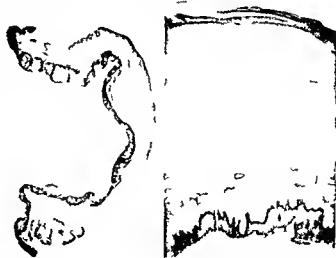


Fig. 6 (600) (at left) Topographic anatomical graph of cross section showing the infolding of the diverticulum made up of mucous membrane and muscle.

Fig. 6 (206243) High magnification of cross section of a diverticulum (see Fig. 5).



FIG. 110

FIG. 111

VAGINAL REMOVAL OF FOREIGN BODY

pure string suture, reporting a number of cases in which the results were very satisfactory. By this method the suture is not removed but is gradually folded up and turned into the lumen of the  $\alpha$  phagus, where it either atrophies or is cut off (used this way I treated two patients by this method). This operation has the great advantage of eliminating every possibility of infection of the mucous membrane and of the cervix. As the suture is composed only of mucous membrane

and submucosa the operation is usually easily performed. The element of infection is very important in this case and when the  $\alpha$  phagus is opened it is sometime difficult to prevent a small amount of soiling. The tissue of the  $\alpha$  phagus tears very easily and even if the sutures are accurately placed in the circle in which a complete section is done the movements caused by swallowing may produce a small opening between the suture. The drainage from the  $\alpha$  phagus naturally



FIG. 943

FIG. (99356)

VAGINAL REMOVAL OF FOREIGN BODY



Fig. 11 (1635)

Fig. 12 (8889)

X-ray photograph of large esophageal diverticulum projecting into the mediastinum

passes down the anterior surface of the vertebrae into the mediastinum and may result very seriously. For this reason whenever the infolding operation as described by Bevan can be performed it certainly is the operation of choice. This method can be employed in the cases of the smaller sacs and in those in which the sac is of medium size but if the diverticulum is very large and reaches down into the thorax it would seem that it is pref-

erable to employ the two stage operation as devised by C. H. Mayo. Murphy described a two stage operation for all cases. The first stage consists in dissecting the sac out of the surrounding tissues twisting it and suturing it in this position and allowing granulations to form about it for from twelve days to two weeks before removing it at a second stage. The method as employed by Mayo is first to dissect the large sac out of the thorax leaving

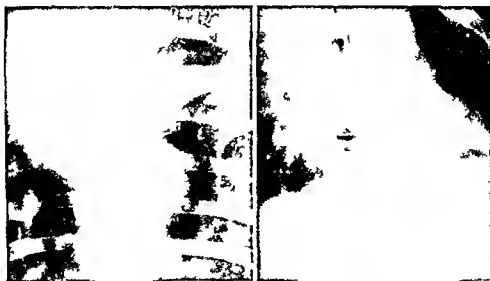


Fig. 13 (49)

Fig. 14 (9786)

Fig. 13 (49) Shows the communication of the diverticulum with the esophagus to be apparently larger than usual. This is probably due to the fact that the sac is not completely filled.

Fig. 14 (9786) X-ray photograph of a large diverticulum at the lower end of the esophagus. The diverticulum is large.





TABLE II

1 1 1 g th pl h f m th l fi je f th  
 1 6 ll t a a l th t f m th r ght d  
 On b f r t t l d l n p e t ul on f d t ul m  
 5 Th c r m g t th Cl  
 t h tr ubl c bout s m th a f Th pat t beg n  
 ope Th t l up q m th l t r ly the t fa e pe t  
 Th l s

TABLE III—TYPES OF OPERATION

The	a		d	t	l		t	d	8 c s
The			l	l	l	ba	l	d	d
t	n n								4 se
Th B	p r t n		j	n v					3 se
Ph t	ts e pe	(L H M y)							
Th		d	t	h	f l l	n	pe at	lx th	th
	dd v	B th p t	s	k		n t	be poe	gic	t
k	m f	u k 76 v		th	th	m l	ag l	1 d	
	Fl	u	f d	th	both		a	d	
t r f	O	t f st r h	n t	r t	o t	op t			
af		r th	a i		n f th	b se			

the neck attached without opening the sac during the first stage. After it is entirely free the wound in the neck is sutured and the sac left out side of the neck in the dressing. The skin edges are sutured to the oesophagus at its juncture with the diverticulum. After ten or twelve days adhesions have formed about the sac and it can be removed without an anæsthetic and the edges turned into the

TABLE 1 — ESOPHAGEAL DIVERGENCE LA

(a	t	i	f	m	f	d	j	a	b
pr			d	v	D	C	H	M	)
N									n
I	m								
A	k	a							9
A	d	r	t	t	m	f	t	m	3
D	l			l					6
R	t	t		d	t	f	l	z	
I	t	m	f	t	m				
D	f	l							3
C	k			th	th	t			
K	k	t		f	f				8
G	k			n					
Tum	f	t		k			l	h	l
ght									
N				ht					8
L	of								9
V	e	p	t						7
C	r	t							5
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asophagus. This operation is not difficult and is perfectly safe from any possibility of infection and has been very satisfactory in our cases in which the ac was fairly large (Figs 15 and 16).

The infolding operation in the case of small diverticula and the two stage operation for large diverticula seem to be very satisfactory and the method of procedure in all cases of diverticula of the oesophagus. The results from these operations are very gratifying and almost every patient thus operated on has been entirely relieved of symptoms.

In our series of 35 cases in which operations were done there were 4 deaths. In each instance death occurred on the second day, both patients were very old and feeble. In one of these because of many general contraindications to operation we taught the pa-

TABLE IV

t	t	t	t	th	e	t	m			33
t	t	t	t	g	y	ft	pe	at		
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t	t	t	t	g	y	r	alt	f	t	
p	t	t	h	g	y		ft	pe	t	
p	t	t	t	g	y		ft	r	i	t
pat	t	t	t	g	y		ft	r	i	t
p	t	t	t	g	y		ft	pe	t	
t	t	t	t	g	y		ft	f	t	
p	t	t	t	g	y		ft	ope	t	
3 p	t	a	t	g	y		ft	pe	t	
f	t	t	t	g	y		ft	t	at	
4 pat	t	t	t	g	y		ft	pe	t	
3 f t	t	t	t	g	y		ft	pe	t	
o p t	t	p	d	t	g	th	p	t	y	

tient to pass a stomach tube and for some months he lived by feeding himself in that manner, then the sac became so large that it produced a great deformity in the œsophagus. The patient could no longer pass the tube and an operation seemed imperative. The first stage of the operation was performed but death took place suddenly the next morning. The history of the second patient is much the same except that the sac was smaller and was removed at one operation. This patient also died the morning following the operation. In two of the remaining cases there was some evidence of a recurrence of the diverticulum. One of these patients was entirely relieved by passing a sound a few times and in the other case it was necessary to reoperate for the recurrence. We have recently corresponded with nearly all of the 33 patients and found them to be entirely free from symptoms.

We believe that the infolding operation and the two stage operation are the procedures preferred and can be performed with practically no mortality.

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EPITHELIOMA<sup>1</sup>

By A. C. BRODERS, M.D. and W. C. MACCARTY, M.D. ROCHESTER, MINNESOTA  
Fifth May, 1914

THE term epithelioma is the name implies is a tumor composed of epithelium without any distinction relative to clinical malignancy or benignancy. If such specific cells as those lining the alimentary tract and comprising the sweat, sebaceous, buccal, salivary, and mammary glands are still to be termed epithelium by histologists then all so called carcinomata are also epitheliomata. The term as utilized in this paper refers only to tumors of the epithelium of the skin, the glandular structures which are a part of it and other structurally similar tissues, although the subject matter does not include such benign epitheliomata as warts, moles, corns, leucoplasia, epithelial horns, etc.

From November 1, 1904 to January 1,

1916 more than 600 malignant epitheliomata were removed at the Mayo Clinic. The regional distribution comprises practically every portion of the human body which is covered by protective epithelium.

## APPARENT TYPES

Structurally the following apparent types are found although they are probably not types but the results of variation in origin and cellular differentiation: (1) squamous cell epithelioma, (2) melano epithelioma, (3) non-melanotic melano epithelioma, (4) basal cell epithelioma, (5) adamantin epithelioma or adamantinoma, and (6) mixed epithelioma.

*Squamous cell epithelioma.* The squamous cell epithelioma derives its name from the fact that the majority of its cells are of the



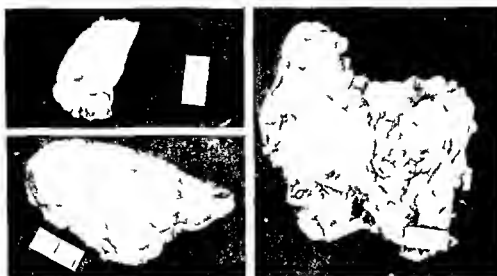


Fig 1 (above) 8 (below)

Fig 9

- Fig 1 Squamous cell epithelioma of lip (A 441)  
 Fig 8 Squamous cell epithelioma of tongue (A 5009)  
 Fig 9 Squamous cell epithelioma of larynx (A 5936)

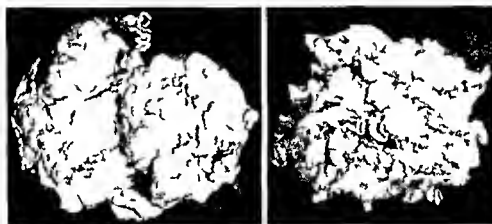


Fig 10 (left) Squamous cell epithelioma of gall bladder (A 6301)  
 Fig 11 Papillary epithelioma of urinary bladder (A 9496)

or without pigment may be seen (Figs 45-46, 47). It has a marked tendency toward alveolar formation (Figs 4-44). This type of epithelioma has been discussed in a previous article by Brodeur and MacCarty ( ).

*Non-pigmented melano epithelioma* This type of epithelioma has all the morphologic and clinical characteristics of the melano epithelioma except pigment. It is usually diagnosed as some form of sarcoma (Figs 18-48).

*Basal cell epithelioma* The tumor is commonly known as the rodent ulcer. Like other epitheliomas it may be found on any surface of the body covered with protective

epithelium. However it is most often found on the cheek, outside of the nose, temple, eyelid, and forehead. It often appears in the skin as an elevated whitish nodule resembling an adenoma or cyst of a sebaceous gland, as an ulcer with indurated borders, or as a scaly lesion which exfoliates its superficial layers leaving a shiny surface but showing little tendency to heal completely (Figs 19-21, 3-24).

The latter form is usually found in persons who are exposed to intense sunlight. It is a frequent occurrence in the sunburnt skin of farmers.

Microscopically the tumor presents an equal variation of the squamous cell type



Talkson (4) held that in the formation of enamel organs for the several teeth there was a surplus and that these additional dental germs were the origin of the adamantinoma. Malassez (7) advanced the theory that they arise from epithelial rests or parodontal epithelial debris. Scudder (10) states: "There is very great likelihood that the cells of the primary epithelial cord having served their usefulness are detached from the original enamel organ cells and may be the cells which persisting form the tumor under consideration." Buchtemann (5) and Koltczek (5) believe that these tumors originate from the mucous membrane or the mucous glands of the mouth. Bland Sutton (1) says: "They probably arise from persistent portions of the epithelium of enamel organs."

The number of theories which have been advanced relative to this tumor naturally leads one to believe that very little is known of its origin. It is usually located in the lower jaw at or near the angle although a certain proportion is located in the upper jaw. Some of them attain the size of a grapefruit. On gross section the tumor proper is seen to be incased in a thin bony capsule made up of cystic and solid areas (Fig. 5). The cysts range in size from 1 millimeter to 3 centimeters in diameter and are filled with a yellowish brown mucoid fluid. They are separated by bony or fibrous septa. The cut surface of a fresh specimen presents reddish granular solid areas and multiple small cysts



Fig. 25 Adamantinoma showing solid areas and cysts (15977)

Microscopically the tumor has a connective tissue stroma and columns of variously shaped masses of epithelial cells. In one instance the epithelial columns showed direct connection with the epithelium of the gum (Fig. 5). This fact tends to suggest that this neoplasm arises from the regenerative or basal cells of the epithelium of the mucous membrane which would be in accord with the histogenesis of all other types of epithelioma. Deeper down in this same



Fig. 18

Fig. 19

Fig. 20

Fig. 21

Fig. 22

Fig. 23

Fig. 24

Fig. 18 Section of a nonmelanotic melanoma of eyelid (118085)  
Fig. 19 Basal cell epithelioma of scalp (150331)  
Fig. 20 Basal cell epithelioma of face (155948)

Fig. 21 and Fig. 22 Basal cell epithelioma of eyelid (133319696)  
Fig. 23 Basal cell epithelioma of forehead (198228)  
Fig. 24 Basal cell epithelioma of cheek (15998)



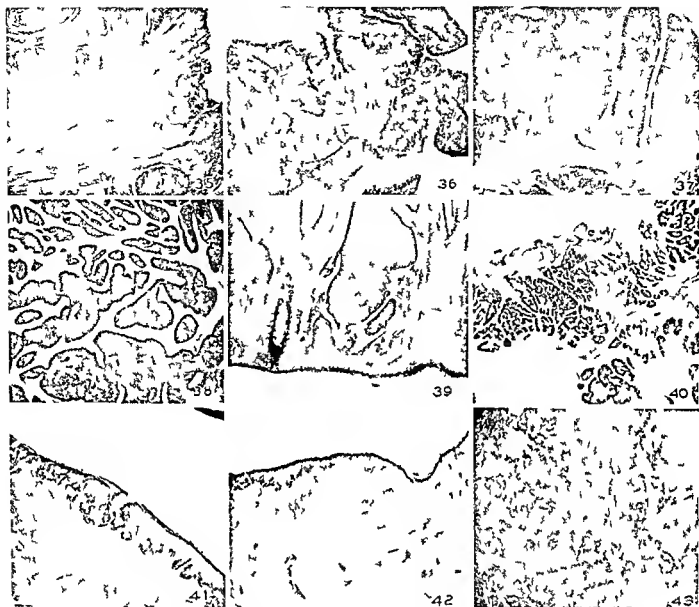


Fig. 35 Squamous cell epithelioma of cervix showing invasion of muscle by epithelioma cells same as Fig. 2 (A6 40)

Fig. 36 Papillary epithelioma of urinary bladder same as Fig. 11 (A9 40)

Fig. 37 Squamous cell epithelioma of tongue. Metastasis from this kind of epithelioma are not frequently diagnosed from kind of carcinoma (A9 40)

Fig. 38 Squamous cell epithelioma of the cheek with a typical appearance of a basal cell epithelioma (A 488)

Fig. 39 Squamous cell epithelioma of the eyelid with

the lower appearance of basal cell epithelioma excepting the epithelial curl (A4 336)

Fig. 40 Epithelioma on the outside of nose having squamous and basal cell intimately connected in the same field. The basal cell presents gland formation (A2 30)

Fig. 41 Early melanopithelioma of the labium (A9 46)

Fig. 42 Melanopithelioma of the right leg same as Fig. 5 (A5 93)

Fig. 43 Metastatic melanopithelioma of a gland of the right gonosector to the right melanopithelioma of the leg same as Fig. 4

derived. The polygonal and stellate cells which are so characteristic represent an advanced stage of differentiation. They sometimes contain prickles which also have corresponding cells in the enamel organ and resemble the prickly cells of the epidermis. These cells appear to disintegrate and form

cysts before they reach the stage of cornification. Similar cysts are found in squamous cell epitheliomata as a result of cell disintegration. New (8) has written an article describing this type of epithelioma.

*Mixed epithelioma.* This type of epithelioma is met with infrequently. It is usually



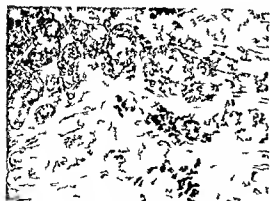


Fig. 44. Microscopic view of the tumor tissue showing glandular structures.

located in the palate although it may occur in other location. Two cases were observed in the Mayo Clinic in which the tumor was in the palate. The first occurred in a girl 16 years of age. It was fairly regular in outline and measured by by 2 inches. When a specimen was removed for microscopic diagnosis an ounce of straw-colored fluid escaped from what appeared to be a cyst. Microscopically the tumor contained squamous epithelium directly connected with the mucous membrane of the palate (Fig. 54). Other areas showed masses of squamous epithelium separated by fibrous septa plus the presence of mucous gland and gland-like structures that were continuous with the squamous epithelium (Fig. 55).

The second tumor occurred in a man 64 years of age. It was encapsulated measured 1 by 1 by 1 inch and on section was found

to be a solid mass free from mucus. Microscopically the tumor contained numerous gland-like masses made up of squamous epithelium in which the central cell had degenerated in a similar manner to that in an adenomatoma. This tumor differed from the first in that it did not contain mucous glands. It also contained what appeared to be true glands like those found in the breast with the exception of mammary groups (Fig. 6). Similar tumors have been found in other locations (9).

#### DISCUSSION

In view of the fact that epitheliomata vary so much in the structure of the cells and their arrangement it seems wise to consider the anatomic possibilities of origin and other reasons for the apparent types.

A clear conception of the structural nature and biologic significance of such an interesting and important group of neoplasms cannot be obtained without a knowledge of the embryologic development of the skin and its accessory organs.

If the life history of the skin is traced it is begun with the ectoderm of the three-layer stage of embryologic development. This layer of partially differentiated epithelium becomes more highly developed to form the so-called skin of the embryo. At first it is composed of one layer of cuboidal cells which with the further development of the embryo become differentiated to form two or more layers of cells. The outer layer differing from the first layer in being flatter



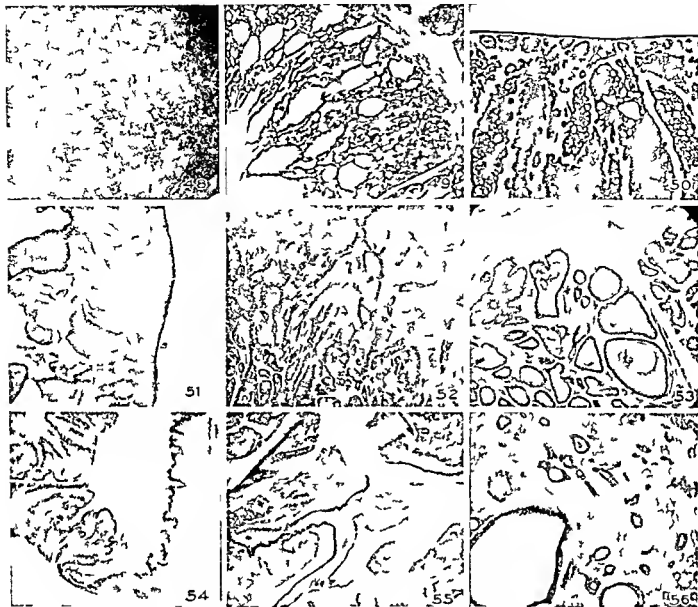


Fig. 48 Nonmelanotic melanoma-epithelioma same as Fig. 18 (A196088)

Fig. 40 Basal-cell epithelioma of the outside of nose. Note the close resemblance to thyroid (A3835)

Fig. 50 Basal-cell epithelioma of forehead showing gland-like and solid areas (A33009)

Fig. 51 Basal-cell epithelioma of nose showing multiplicity of cell types (A38366)

Fig. 54 Adamantinoma showing direct connection with the epithelium of the gum (A69435)

Fig. 3 Section from center of tumor shown in Fig. 52 showing different types of cells and early cyst formation

Fig. 54 Mixed epithelioma of palate showing direct connection of tumor cells and epithelium (A147265)

Fig. 55 Different field in same case as Fig. 54 showing squamous and gland epithelium intimately connected. Note the mucous gland in one corner

Fig. 56 Mixed epithelioma of palate showing squamous epithelium and glands similar to those of the breast in the same field (A56093)

or less cuboidal with their long axes parallel with the surface of the body.

With both antenatal and postnatal development the secondary layers become more differentiated. In this stage embryologists have termed them the stratum germinativum of the skin or the germinating layer of the epidermis.

The history of the cells of this layer proves that they retain the power of divergence into several structural and functional derivatives. It may be spoken of as a plastic layer at least in the embryo. This expression of its broad functional capacity is based on its behavior in the development of the appendages of the skin, namely, hair, nails,



1. The first of these is the fact that the system is not in a steady state. The system is in a steady state only if the rate of change of the number of particles is zero. This is not the case here, as the number of particles is increasing with time.



4. 5



$\Gamma_5$   
 $f \ 11 \ 1 \ m \ f \ f \ 1 \ 1$   
 $f \ 1 \ f \ 11 \ 1 \ f \ 10 \ 00$

te th sweat gland    sebaceous gland    mucous gland    endocrine gland

Histologic specimens taken through the embryonic kin and about one to two mm. in a portion of the developmental activities of the tritum germinatum other than the production of epidermal cells.

The liver is the site of a wide variety of products of the liver cell that are not only available in embryonic development but it may be seen in the human from lumbar epithelium of the liver to the uterus, cervix, the urinary bladder and the mouth in all of which in the regenerative cell produce junctional epithelium in the oral cavity of a lumbar epithelium when a protective cell is present.

It has been shown definitely that rebr u de structure is possible as we gave rise t certain definite histologic biologic and clin ical phenomena in the regenerative cell t uch to us. These are characterized hi tologically by hyper trophy hyperplasia and migration biologically by hyperactivity re productive (ne plus) and migration and clinically by benignancy uncertainty and malignancy (1). It has been shown furth r that the cells at the migratory (malignant) stage when they acquire in environment somewhat similar to their normal environ ment attempt to differentiate into the tissue cells for which they were originally intended. This is seen in the case of gland

ular to use as well as protective epithelial tissue. In the case of the epitheliomatous underdevelopment in this paper there are several possible points of origin. The germinal cells of the epidermis, sebaceous glands, sweat gland, oral and nasal mucous lining and the hair follicle all constitute possible sites of origin in the placenta. Neoplasia arising in the latter is not included in this case, but the nature has already been seen by the writer.

It critically, no should be able to determine the origin of the pluriform character of the differentiation in the new growth. While this may be theoretically possible it is only infrequently possible because the dominant neoplastic cell rarely if ever becomes completely differentiated although it may would be the main condition because they would only produce the very origin of cells in the partially differentiated portion of the malignant neoplasms which are more nearly morphologically like certain tissues than like any other tissues seen in the body. A special case is has been noted in the case of certain epitheliomas in which the cell undoubtedly resemble cornified epithelium and endothelial cell. In the case of hair follicle the only evidence that exists from the possible origin of some of the epitheliomas in the structure of the fact that only multicentric neoplastic cells have been found arising in the stratum germinativum of the follicle (Fig. 10)

There is one other possibility within the range of analogy to facts as they occur in the human body. From the reaction of regenerative cells of tissues which by the so called process of metaplasia become transformed from columnar cells into stratified squamous cells it seems possible for the regenerative cells of any of the accessory organs of the skin to produce cells similar in structure to those of any other accessory organ. This possibility is merely mentioned to stimulate investigation and in no way is it held to be responsible for any of the conditions reported herein.

In presenting this brief description of typical malignant conditions arising in the skin and its accessory organs practically no attempt has been made to report the clinical aspects of the subject. The results of detailed gross histologic and cellular studies

with their clinical significance will be presented elsewhere in the near future.

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## EXFOLIATIVE VAGINITIS

By WILLIAM KERWIN, M.D., St. Louis

From the Department of Obstetrics and Gynecology, St. Louis University

SINCE 1901 when Gellhorn reported a case of exfoliative vaginitis and collected the meager literature on the subject no further instance of this exceedingly rare condition has been recorded. The two cases which it has been my good fortune to observe therefore merit publication.

**CASE 1.** A woman of 30 came under my care in December 1910. History: Previous health fairly good. Menstruation began at the age of 14 and has never been regular, the interval ranging from two weeks to two months. The flow lasted two days but in the last few years the amount has diminished and the duration decreased to half a day. She has had dysmenorrhea throughout her menstrual life. She had one normal confinement nine years ago and one miscarriage four years ago. Since the birth of her child pain has been constantly present in both lower quadrants of the abdomen but more severe on the right side. Examination showed a small intramural fibroid situated anteriorly in the angle between the cervix and the body of the uterus. Nothing else abnormal was found in the pelvis. In March 1911 the fibroid was enucleated and the chronically inflamed appendix was re-

moved. The patient enjoyed good health until September 1911 when she returned stating she had passed a sac from the vagina a few days ago but aside from a few cramps this did not cause her much discomfort. On examination nothing abnormal was found except a highly colored vagina. Two weeks later she returned bringing with her a sac which had passed in the same manner. The sac proved to be a complete cast of the vagina; the latter was again found to be highly reddened. Forty of the casts were passed from September 1911 to September 1912 at interval of one to three weeks. The expulsion of a cast was in no way related to menstruation or influenced by sexual intercourse, douche, excitement or the like. The patient was unable to give any explanation for the formation of the cast. She was kept under fairly close observation to eliminate all possible cause such as douches and suppositories but the casts continued to form and pass.

**CASE 2.** A woman of 39 years visited the gynecological clinic of the Washington University Hospital to ascertain why she had not menstruated for the past year. No symptoms of any nature were present. The menstrual history had been normal and she had passed through three normal pregnancies. On examination the introduction of the index



4 Frienkel 5 and Lee 6) think that it is usually combined with exfoliative endometritis and according to Garrigues (7) found in hysterical women or as in Griffiths (8) and Hopkins (9) cases it may appear together with a membranous enteritis the latter being generally believed to be of nervous origin. The cases reported by Porter (10) show that exfoliation of the mucous membrane may occur in the course of a severe inflammation following masturbation.

The majority of authors however (Tyler 11 Ziegler 12 Veit 13 Gebhard 14 Pozzi 15 and Keating 16) consider thermic or chemical irritants the main causes of the exfoliation. These authors maintain that the lining membrane of the vagina separates in the form of translucent flakes in consequence of the use of douches which are too hot or those which contain an excess of caustic ingredients such as phenol or chloride of zinc. The same widespread exfoliation of the epithelial coat of the vagina is seen following the use of strong astringent drugs. To this group belongs Gellhorn's case in which a complete exfoliation was caused by vaginal suppositories containing a caustic substance the exact nature of which could not be detected. In neither of my own cases could any etiological factor be elicited. It is possible that bacterial infection or pathological changes in the deeper vaginal tissues play a role in the causation of the condition but numerous smears made at different periods from the vaginal secretions in my cases showed nothing unusual and as such cases do not come to autopsy material for microscopic study of the deeper vaginal structures is not obtainable.

The changes in the vagina seem to be quite typical and while the process may begin in any portion of the canal it usually begins near the vulva (Lee). The surface of the vagina is covered with a white coating and pieces can be removed with a forceps. This may be attended by discharge from the subepithelial surface while in other places the vagina appears quite dry (Smith).

In my own cases I have found the vaginal mucosa highly colored immediately after expulsion of the cast. Repeatedly puncti-

form bleeding was seen here and there where the exfoliation had exposed the papillae and opened the capillaries in the latter. This process is somewhat analogous to the minute bleeding seen in scabic vaginitis and in psoriasis when the scale is lifted from the skin. Within four or five days after the cast is expelled the vagina regains its normal appearance and the lumen remains unaffected. A marked reduction in the width of the vagina can take place only when the exfoliation has taken place in the deeper layers and the subjacent connective tissue is exposed but even then contraction of the vaginal canal need not occur as shown by the case observed by Barsonkoff (17) where a patient had a hemorrhage as a result of sulphuric acid poisoning. A few days later without any elevation in temperature she passed a large slough representing a complete cast of the vagina. This included the entire thickness of the vaginal wall and some of the adjoining connective tissue yet the vagina remained normally patent.

The exfoliated shreds or laminae bear the marks of the rugae of the vagina. If the process effects the entire vagina at the same time there results a complete cast of the vagina which however seems to be exceedingly rare for the only cases which exhibit this completeness of the molds are those reported by Gellhorn and Barsonkoff and my own two cases. While practically in all instances the exfoliation took place but once the formation and expulsion of vaginal casts in my second case occurred three times in Gellhorn's case nine times while in my first case this startling phenomenon manifested itself forty times in one year.

The symptoms accompanying this condition are not always sufficiently marked to attract attention if present they precede the expulsion of the cast. For twenty-four hours there may be sharp cramp like pains in the lower abdomen. A slight discharge which at times is streaked with blood is noted. When the cast is not expressed easily the pains become expulsive in nature and these pains last until the patient is relieved. In such instances considerable bleeding is present at the time the cast is expelled.

or removed as was found on a number of occasions in my first case.

The appearance of the vagina makes the diagnosis easy. Before the separation of the cast the vagina takes on a whitish appearance, the changes first occurring near the vulva as a rule. Pieces of membrane can be picked off the vaginal wall and this leaves behind a bleeding surface. When the cast has been completely thrown off the new mucous membrane has already formed but appear to be highly colored. It is sometimes necessary to differentiate the condition from exfoliative endometritis but this offers no difficulty. The vaginal casts are larger and have two openings and the vagina has a characteristic whitish appearance during the separation of the cast. It is to be remembered that the two conditions may occur simultaneously.

No local treatment seems to influence the condition. If the cause can be discovered and removed, the trouble usually

## SUMMARY

Exfoliative vaginitis is a rare affection which is characterized by a superficial necrosis of the vaginal mucosa. The process manifests itself in the expulsion of a complete

cast of the vagina or of more or less extensive pieces of the mucous covering. Microscopically the discharged specimens are composed of vaginal epithelium. The etiology of the disease may, as a rule, be traced to thermic or chemical irritants but no such cause could be elicited in my two cases. Of these the first occupies a unique position in literature in so far as number and completeness of the vaginal molds are concerned.

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 4 I t H D k kh t d r p 57  
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## FIBROSARCOMA OF THE MESENTERY 1

B BETHFI SOLOMONS MID I R C I I Dc t I  
Cy I M Hos I D bl

THE tumor was removed from a patient age 3 who was admitted to Mercers Hospital, Dublin on November 3, 1957 with the following history:

The patient is a 31-year-old married female and the half-sister of the patient. The first pregnancy was in June 1966. She said that 10 years previously she had felt a small lump in the abdomen which gradually increased in size but did not produce any symptoms other than mild ache until Thursday, November 1, when she complained of severe abdominal fullness in the abdomen, loss of appetite, constipation, and a large tumor. There was no menstrual abnormality, and the fact that the amount was so metime copious. She was treated in October 1976.

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On agn l examin t on the cr v ter a fou l

She had trusted in God. She had trusted in the Lord.

to be in the long axis of the vagina. The body of the uterus and the adnexa could not be distinguished separately from the tumor. I decided to operate. When the abdomen was opened it was only possible to get two fingers in for the tumor was adherent to the parietal peritoneum. By carefully separating with the fingers it was at length possible to get the hand into the abdomen and to separate the tumor from the parietal peritoneum to which it was adherent in the full extent of the abdomen. When at last the mass was delivered it was apparent that many feet of intestine and much mesentery were attached to it. The intestines were sponged off the growth with wet wipes, a small pedicle stretching from the mesentery was ligated with catgut and the tumor was removed. The examination of the pelvis revealed a normal condition of the uterus and adnexa.

The abdomen was closed the patient had an uneventful convalescence and went home on the thirteenth day.

Professor O Sullivan kindly examined the specimen at the Dublin University Laboratory and made the following report:

The tumor forms an oval mass about 10 inches in length and 7 inches in breadth. It consists of two parts separated by a firm capsule. The larger part is of a uniform dark red color with areas of deep black the consistence that of a ripe pear it cuts easily. In place there are cavities the largest about 1/2 by 3/4 inches with a shiny surface. These contained a thin red fluid a great quantity of which poured from the cut surface when the tumor was opened. The smaller portion of the tumor is on the outside very dense dead white in color. The inner portion is degenerated and broken down leaving a cavity with ragged edges containing a brownish fluid.

On microscopic section the larger part of the tumor showed a tissue composed of wavy fibers more or less dense and cells scattered through them with thick oval or rod shaped nuclei of small size. Mitoses were not observed. In some places the fibers are very dense in others they run in thick strands nearly parallel leaving narrow spaces between them. The spaces do not appear to have any regular cell lining. Many of the veins in this part of the tumor are thrombosed. The tissue around these thrombosed veins is edematous. Hemorrhages occur in places and a certain amount of blood pigment was seen in unstained sections.

The smaller white portion of the tumor shows on the outside a dense capsule of compressed fibers with no nuclei visible. As one passes inward the fibers become looser and the tissue becomes more and more cellular. The nuclei of the cells become more various in size and shape and the tumor takes on the characters of a spindle celled sarcoma. Further in the growth becomes completely necrotic breaks down and forms the thick brownish fluid mentioned above. The vessels in this part of the growth are calcified.

I think the term fibrosarcoma describe the character of the growth.

The large benign portion of the tumor was superior in the abdomen and it was from this that the pedicle sprang. It will be seen that the main part of the tumor was a pure fibroma and Professor O Sullivan cut many sections to verify this. Blind Sutton states that pure fibroma is a very rare condition and he dwells on the difficulty in distinguishing between myomata slowly growing spindle celled sarcomata and pure fibromata. He points out that fibromata may occur in the ovary the uterus or in the intestine apart from two or three other extra abdominal situations and the question in this case is: What was the origin of the tumor? There are several possible solutions of this problem.

1 That it arose from the intestinal wall. This may be disregarded.

That it was a uterine tumor with a thin pedicle which at some time or other had become separated from the uterus that it had become adherent to the mesentery and in testines and had formed a pedicle to the former. This is unlikely for there was no sign of such separation.

3 That it was a mixed tumor of embryological origin. The last seems to me to be the most feasible hypothesis for when the embryological question is considered it is found that Fuss in his work on the genital cells of man and mammals traces the path of these cells from the entoderm of the yolk sac to the genital region in later stages and holds that inclusive of the human embryo the so called germinal epithelium plays only a very unimportant role in the genesis of the sex cells and begins to proliferate only when the majority of the genital cells coming originally from the yolk sac entoderm i.e. the epithelium of the alimentary canal have arrived at their destination in the genital region. In other words the tumor might be due to a wandering genital cell which should have gone to the genital tract in which case the tumor might have been found to arise from the uterus or the ovary.

Bl d s t T m r s  
F A h f m k A n t o l o Q t d l y B m  
H J A t d P h y l i



# SURGICAL METHODS IN THE TREATMENT OF MALIGNANT AFFECTIONS OF SUPERFICIAL LYMPHATIC TISSUE<sup>1</sup>

B. J. LATTES, M.D., F.A.C.S., MILWAUKEE, WISCONSIN

A MALIGNANT affection of lymphatic tissue may be regarded as an inflammatory or neoplastic process which provokes in an individual no sustained tendency to local recovery and possesses the power of ultimate extension by whatever means to increasingly more widespread involvement of this tissue leading thereby directly or indirectly to death. Such affections may originate in lymph glands or having begun in other tissues show in their manner of extension a predilection for the lymphadenoid tissue. It is conceivable that primarily all are reactions to some form of irritation and are focal in origin.

The degree of preponderance of the destructive potentiality of any given morbid process over the power of local and general resistance of the individual determines its relative malignancy. Accordingly tuberculous lymphadenitis would be considered a slightly malignant affection in a minority of individuals, carcinomatous involvement of lymph gland a very malignant process in a great majority whereas the entire group of closely related diseases leukemia, aleukemia (aleukocythemic), leukemia, chloroma, lymphoma, primary endothelioma of lymph glands, malignant lymphoma, Hodgkin's disease, etc., has hitherto been accepted as hopelessly malignant.

As a result of the attention that has been given to the problems of tuberculosis, tuberculous lymphadenitis has not alone decreased in frequency but has also come to be considered so benign an affection that its possible menace to life is now a Dowd's work indicates dangerously underestimated. The cure of cancer proclaimed an impossibility by only the last generation has not alone been established for virtually all tissues primarily affected but the proportion of recoveries is steadily increasing. Permanent recoveries are recorded in individuals who had suffered from Hodgkin's disease.<sup>2</sup>

This progress has come in part through a practical appreciation of the manner of inception and the modes of advance of disease and in part through a combination of the operative procedures thus found to be indicated with such measures in postoperative treatment as lead to an increase in local and general resistance. For example it has been demonstrated that the removal of all accessible tissue affected in tuberculosis is not essential to a permanent clinical recovery in every case though some individuals will only so recover after a major portion of this tissue together with the primary focus has been extirpated even if the best of general treatment has been provided from the onset of this disability. Similar observations have been made in the treatment of Hodgkin's disease. Likewise a carcinomatous mass may disappear spontaneously and permanently though the disease persists or extends elsewhere or an individual may make a permanent recovery following an incomplete excision of a cancer.

It is difficult to explain such phenomena upon any other basis than that of immunity hence the significance of the factors entering into the constitution of local and general resistance.

The work of Bunting, James B. Murphy and Theobald Smith indicates that the functional integrity of the lymphatic system is one factor of fundamental importance in the defense against the malignant processes. On the contrary Tyzzer's careful observations upon the modes of invasion of an unusually malignant transferable mouse cancer have convinced him that in carcinoma the lymphatic more particularly the lymphocytic reaction is less significant. It is perhaps fair to state in this connection that in the presence of extreme malignancy a very limited reaction of this type is to be expected hypothetically.

B. J. L. H. P. B. S. S.  
M. h. d. M. t. J. E. p. M. d. v. s. . .

Experience gained in a prolonged study of all these diseases has led me to a conviction that an accurate interpretation of the leucocytic formula with due consideration of all other evidence is at present the most reliable and delicate indicator of the state of general resistance and of the immediate and remote effects of treatment upon it. Comparative histological studies of tissues obtained at operations during different stages of a disease in the same individual as well as of that excised from other patients of different ages and various stages and types of the same affection justify the following tentative assumption. Local resistance varies directly with the ability of the irritated tissue to react with the least abnormal regenerative variations. These consist in an intensive round cell infiltration succeeding a constant neutrophilic and more variable eosinophilic accumulation and preceding a fibroblastic proliferation which is accompanied by the development of few or no abnormal cell (e.g. giant) forms or cell (e.g. sarcomatous endotheliomatous) growths.<sup>1</sup>

This assumption holds true in spite of the fact that no power of specific tissue regeneration is more important or its impairment more easily recognized than the hematopoietic because in these chronic diseases the variations in histogenetic powers appear gradually and there usually are differences between those of diverse tissues or even in the same tissues in several parts of the body. In exceptional instances an individual apparently in fair condition may prove to be incapable of making fibrin adequate to primary healing or quite the contrary may be the fact. A possible explanation of such perplexing observations is the considerable fluctuation in the reserve powers of local and general resistance which repeatedly approach the vanishing point after the early stage in these types of disease. This would explain the difficulty in forming therapeutic judgment

a matter of prognosis dependent as it is entirely upon those indeterminate factors and their unknown interrelationship.

Divers as are the diseases here considered we believe that they exhibit in their methods of attack and in the protective reactions they provoke such constant phenomena common in some degree to them all that therapeutic principles established for one find rather general applicability. The type of surgical intervention to be advanced as essential is based upon the interpretation of the pathology of malign affections given above and upon the following conception of common features in morbid physiology. The powers of resistance of the individual usually after an initial rise decrease progressively though irregularly. If the process be unchecked sooner or later a material diminution in resistance prone to be sudden is manifested clinically by an acute intensification of symptoms and often by a proportionately rapid dissemination of the disease. A progressive anemia secondary in type is constant. Cachexia is common in the more chronic forms and all except possibly uncomplicated cancer are febrile at some stage of their progress. Indeed the clinical pictures exhibited by some individuals suffering from these diseases may be so similar that a positive diagnosis is possible only through a histological study of the lesion by a competent pathologist. Generally the extent of the disease revealed at operation or autopsy exceeds that recognized at previous examinations. Quite as constantly but to an even greater extent the reserve powers of resistance and regeneration are less than can be estimated by any clinical methods now available.

Rational treatment is an exact play upon the powers of local and general individual resistance against the inerradicable portion of the morbid process. This method of attack must be based upon an accurate knowledge of the factors leading to therapeutic failure rather than upon a general conception of empirical methods reputed to have preceded fancied or occasional recoveries or by accepting any less accurate philosophy of treatment even though successful in a high percentage of reported cases. Subject to individual vari-

NOTE.—Sarcomatous metamorphosis of the connective tissue framework in carcinoma has been seen to occur spontaneously in human cancer and has been produced experimentally by Ehrlich. Comparable transformations have been noted in Hodgkin's disease by numerous observers and I have recognized at least one example of a similar change in tuberculous lymphadenitis.

tions the clinical applications of the therapeutic measures leading toward recovery are easily stated. First the primary focus or portal of entry of the disease must be eliminated. Second a subtraction from the total amount of disease adequate to place the balance of power emphatically upon the side of individual resistance must be so achieved as not to decrease general resistance yet to increase local resistance by the prevention of local recrudescences. Third the subsequent play upon the power of general and local resistance must be continued long after all evidence of the disease has disappeared.

Surgical methods are subject to such great variation in application that they are more presentable in principle than in technical detail. Extreme example will show the limit of the variation.

The earlier and more reliable the disease the more radical should be the extirpation. It is always safer to assume that the process is more than apparently benign of greater dissemination than demonstrable and that individual resistance has been diminished dangerously. This only can a patient suffering from a potentially lethal disease be given a chance of recovery with minimal danger at a time when if the prognosis should be good. The usual hypothetical objection to this proposition can be answered by the result of clinical experience.

Mortality from radical operations under taken at an early stage of disease should be no greater than after incomplete interventions. Wound healing is as rapid and as favorable and convalescence therefore not more protracted. Functional results are similar since with one possible exception every essential vessel, nerve and muscle can be preserved. Even the cosmetic results negligible as they are under such conditions may be made but little more unsatisfactory. The inherited superstition that lymph glands thus eradicated do not regenerate is contrary to fact. Such regeneration is in adults a matter of a few months and if not subject to prompt re-involvement thus recently developed lymphadenoid tissue is locally hyper-resistant and contributes to increased general resistance as well. In the presence of early recrudescence

just the reverse is true. This is the irrefutable pro radical argument.

The other limit is presented in patients incurably affected in which for whatever reason palliation is indicated. These individuals have lost their regenerative capabilities to such an extent that the problem is now to obtain a sufficiently protracted local relief to insure physical and psychic anchorage for the remaining period of life. Extremely radical dissections are occasionally contraindicated. A decision as to what to attempt under such conditions is extremely difficult because of the impossibility of estimating the reserve powers of resistance. In spite of the higher operative mortality in this group of patients intervention is justified since proper judgment as to treatment may gain a respite of months even years of hopefulness.

Between these extremes there is so large a range of therapeutic possibilities that indications for the application of surgical procedures to neck, axilla and groin must be restricted to an outline of the more dangerous gland groups and an indication of satisfactory method of extirpating them. The distribution of lymph gland and groups of lymph glands that have been found to be subject to involvement differs somewhat from usual teachings and although based primarily upon observations made in the study of Hodgkin's disease and allied afflictions identical and occasionally even greater involvement has also been observed in both cancer and tuberculosis.

*Neck.* In the cervical region the group of greatest danger because they are most commonly neglected and are of constant and frequent involvement are widely separated. Beginning at the upper margin gland are found within the capsule of the submaxillary salivary gland also above and behind that structure. Two or three glands are so constant in the lower portion of the protoid that this part of that gland should be included in all radical excisions. The mastoid lymph gland is always dangerous. A group rather difficult of access when the mastoid muscle is retained lies just behind its attachment and between the origin of the internal jugular vein and the trapezius muscle. Along the anterior limit

in the midline glands are so common from the submental group to the sternum that dissection must extend beyond this midline. This is particularly true in the suprasternal region. The fat surrounding the insertions of the sternomastoid muscles is gland bearing and is not infrequently the pathway of extension of disease from one side of the neck to the other. Within the musculotendinous part of the lower mastoid muscle there is a gland in a small proportion of individuals but it is sufficiently common to demand the division of the insertion of this muscle when its removal is indicated as close as possible to the sternum.

The posterior margin has been a site of recrudescences after supposedly radical extirpations because a group of glands lying on the external surface of the trapezius muscle at its upper third had been neglected. Likewise a chain lying behind the anterior margin of the muscle increasing in numbers toward the lower end has been overlooked with disastrous results.

The inferior boundary presents the greatest difficulties because of the necessity of blocking temporarily all lymphatic pathways leading to the mediastinum and axilla. In front of the clavicle at its inner third lymphatics connect those of the neck and upper chest and extend at least under pathological conditions into the axilla through the interval between the costal and clavicular portions of the pectoralis major. Behind the middle third of the clavicle is the most constant connection between neck and axilla through lymphatics lying both in front of and behind the vein. These latter are of great importance and will be discussed later. At the outer third preclavicular extension occurs but is uncommon. Still more infrequently there is transmission between neck and axilla in the lymphatics of the fat surrounding the insertion of the pectoralis minor. Extension to the mediastinum may occur either in front of or far more commonly indeed almost constantly behind the deep veins. So regular is this involvement that removal of all fat from the region behind the juncture of the subclavian and jugular veins should be a routine.

The deep lying glands in the area included

within these limits are both numerous and widespread. A chain lying behind the jugular vein is constantly involved and as a rule easily removed without injuring the vein or nerves. The groups lying equally deeply but more laterally are possibly the most dangerous. They are imbedded in thick fat especially farther outward where a large group is constant and is connected with the axilla just posterior to the axillary vein and still farther outward and posteriorly by a chain lying in the fat on the anterior surface of the subscapularis muscle. Extirpation of this gland bearing tissue should be done regularly even if no palpable glands are present as they can be considerably involved under such conditions.

Technically the dissection thus indicated extending from above the margin of the jaw to below the level of the clavicle and from beyond the midline medially to behind the anterior margin of the trapezius laterally is tedious under the most favorable conditions and when the disease is extensive and adhesions dense it becomes exceedingly difficult. Generous incisions giving wide exposure when the skin is reflected can be variously placed. One of the Bastronelli type is the easiest to make but gives very unsatisfactory functional results when there is any tendency to cheloid or when the repair is delayed. Beginning over the base of the mastoid cutting downward and backward an inch or more behind the margin of the trapezius then continuing downward almost to the level of the clavicle and following the natural skin creases thence forward to a point beyond the opposite sternoclavicular joint will give after a wide forward reflection of this quadrilateral flap an abundant exposure to reach all but the submental glands. These can be secured through a small additional incision. The actual dissection is facilitated by systematic methods which must not be too inflexible as in some individuals it is easier to excise from a direction which might be impossible in another. In general after reflecting flaps it is convenient to work from all margins toward the center until the eleventh nerve has been located and freed and the internal jugular exposed. The operation indicated for the

particular problem disclosed is now determined. Then depending on whether the mastoid muscle and jugular vein can be spared the next steps follow in natural sequence. No important structures should be sacrificed wantonly and usually *patience and a sharp knife* will bring surprising results. Two little procedures are helpful in extirpating these deep glands. The dislodgment of the fat from the deep triangular space between clavicle and subscapularis muscle and ribs can be started safely with a knife handle and completed with gauze thus sparing important nerve trunks. Before removing the tissue from behind the subclavian jugular angle it is well to have the rest of the dissection along inferior and mesial aspects completed as there may be an anomalous vein here that is easily torn and the consequent bleeding difficult to control unless all possible access is provided. It is not always possible to avoid injuring the thoracic duct. If it is accurately sutured or ligated completely there is no further trouble. A leak is a sorry complication. The right duct is less troublesome but venous bleeding on this side is equally trying to control. Heat and pressure make accurate clamping possible.

These wounds should be subjected to X-ray exposures at the conclusion of operation and repeatedly thereafter. This irritation is not conducive to smooth healing consequently a careful closure is demanded. A formation of the most complete muscle floor made possible by spreading the margins of the muscles tacking them to each other and to available fascia more than repays the time required by its accomplishment. The obliteration of dead spaces the covering and protection of nerve trunks especially the spinal accessory and hypoglossal and the provision of a firm smooth basis with adequate nourishment for the skin flap really a whole thickness of graft is thus achieved. Subcutaneous coaptation in addition to a usual skin approximation is necessary. Both should be done with interrupted stitches. The best results are obtained when no catgut is used. Dressings also play an important part in the healing. The head must be held inclined toward the shoulder of the operated side and held securely. Large dressings make possible an even firm pressure

on the whole area of operation. If drainage is indicated small soft rubber tubes so arranged that they may be withdrawn after twenty four hours without removing the bandage are satisfactory. It is well not to change dressings for two or three days to avoid even trifling motion. These patients usually sit up by the second day and are out of bed on the third.

**Axilla.** At the beginning we wish to emphasize that while the axillary dissection is the easiest of the three regions repair is the most tedious if one attempts to save the pectoral muscle and the functional results are often less satisfactory when this is done. More over a complete excision of dangerous tissue is impossible under this handicap.

The relationship of the upper margin of the axilla to extension of disease to and from the neck has already been considered. Superficially there are in addition pathways of dissemination toward the midline anteriorly leading along the perforating branches of the internal mammary to within the thorax or more superficially still to the opposite side of the chest. In exceptional instances glands are to be found in the attachment of the pectoralis major muscle at about the level of the fourth costal cartilage consequently when this muscle is excised it should be removed as completely as possible as the lines of extension lie not only upon both surfaces of the muscle but actually within it as well as through the space between its two portions. In the deeper tissues glands occur above the level of the veins so commonly that all the fat lying here upon and between the nerve trunks of the plexus should be removed including that about the insertion of the pectoralis minor. The most frequent line of extension in the chain of glands lying along the lower and anterior aspects of the axillary vein is not completely broken unless all the fat is removed from beneath the costoclavicular ligament. If the trunks of the external respiratory and the long thoracic nerves are located as can be easily done by the overlying veins then the entire mass of fat lying anteriorly to the subscapularis can be removed safely from a level well above the vein posteriorly and downward to the attachment of the latissimus dorsi and posteriorly

well back on the serratus magnus thus cutting off more dangerous pathways toward the spine and neck. The posterior margin of the axilla shows a constant chain of glands extending on the chest wall along the anterior margin of the latissimus dorsi and also upon both its anterior and posterior aspects. The lower anterior axillary margin may lead to an extension of disease in the intra abdominal epigastric lymph glands as well as to hepatic (Handley) involvement. The anterior axillary margin communicates under pathological conditions so freely with the opposite side as to be a constant menace. Another source of danger is the lateral segment of the female breast. Lymph glands are found in this tissue and when radical operations are done for disease not intrinsically mammary at least the whole outer margin of the gland should be sacrificed. Direct extension through the intercostal muscles occurs when there is advanced disease high in the axilla but only when it is so advanced that no intervention is to be considered. We contend upon these grounds that a radical extirpation for mammary cancer to be rational must include the subcutaneous fat and superficial fascia over an area extending from above the level of the clavicle down nearly to the umbilicus from beyond the midline anteriorly backward well behind the anterior margin of the latissimus dorsi. Virtually all of both pectorals must be included as well as the fat above and behind the vein and backward in the hollow of the scapula. Such wounds heal splendidly and if the cephalic vein be spared give better functional results than when even the costal portion of the pectoralis major is saved. This statement is based upon results obtained by different methods applied to the same individual. The reduction of oedema early and late and in the period of disability of the side operated on more radically is definite and the functional result is better. Under other conditions than cancer when less radical methods are indicated the selection of a suitable operation is extremely difficult. If the tissues beneath the pectoralis major are sufficiently thoroughly excised to justify the intervention the process of repair is retarded by the dead space created no matter what plastic methods

may be applied to obliterate it. The problem becomes one of balance between the dangers of reduced local resistance liable through early regional recrudescences and disability. Wound closure is along the lines indicated for the neck and usually results in prompt superficial healing ten days or two weeks later the deeper mischief begins to show itself. No drainage that we have been able to devise will eliminate the complication in these extensive but incomplete excisions. When the operation has been complete i.e. a resection of all of both pectorals drainage is frequently unnecessary and the healing is prompt provided the radiation is not carried beyond the limits of resistance to this irritation.

*Groin.* The inguinal region presents comparatively little difficulty. Superficially the dangerous gland bearing area extends slightly above the level of a line between the anterior superior spines below to about the junction of the upper and middle thirds of the thigh mesially on to the abductor longus and laterally to within the line of the anterior superior spine. More deeply it lies mainly along the femorals and iliacs upward to the promontory of the sacrum. The only problem to be considered here is whether deep dissection is to be carried above the level of Poupart's ligament. The line of incision is of importance as upon it depends primary union of the skin. If made slightly to the middle side of the area indicated and curved convexly outward the resultant healing is good. If made convexly inward a slough is assured. After reflexion of the skin edges the fat and fascia are removed down to the external oblique fascia above Poupart's and beginning an inch below the ligament the entire fascia lata is excised over the exposed area. The external cutaneous nerve and the long saphenous vein must be spared. If in addition the glands along the iliac vessels are to be removed the fascia of the external oblique is incised as in a herniotomy the lower margins of the internal oblique are retracted upward and the peritoneum is elevated. This may be accomplished without division of the deep epigastric vessel though usually this division gives a better exposure. With blunt dissection clamping resistant bands before dividing them removal of fat

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# THE INDUCTION OF LABOR AT TERM<sup>1</sup>

## A SUPPLEMENTAL REPORT

By CHARLES B. REED, M.D., F.A.C.S., CHICAGO

IN these years of growth shift and psychological change it is much easier to rid our selves of traditional methods and outworn shibboleths than it was in the past when environment and the unyielding bands of authority held the mind in close restraint.

It is no longer necessary to cultivate the soil as our grandfathers did nor to refuse to employ in our medical work scientific advantage unknown to our fathers. The agriculturist of today would not permit his crops to fail from lack of rain if irrigation was available nor would the mariner leave his vessel to the fortuitous direction of wind and current for fear the utilization of his experience and scientific knowledge might be called an interference with the processes of Nature or an attempt to circumvent the intentions of Deity.

We recall the sincere but no less reactionary cry of Meigs against the assertion of Holmes that puerperal fever is a private pestilence. Meigs was then Professor of Obstetrics at the University of Pennsylvania. He said: "I would rather believe that the fever is due to the workings of a Providence that I can understand rather than to an unknown infection of which I can form no conception. The world continues to move and it is no longer sufficient to feel that we can mark time as pensioners of Providence nor by watchful waiting evade our duties. It is increasingly evident that in obstetrician who wishes to be more than a midwife must accept responsibility, decide and act with creative energy and farsighted intelligence."

So the induction of labor must stand or fall through its acceptance by the younger men of the profession or at least by the elastic and open minded who will not hesitate to assume their responsibilities and carry them through not only with confidence but with an abundant faith in their technique and in the quality of their scientific inspiration.

They must individualize their cases however and be just as careful to avoid precipitant action as meticulous and vacillating delays.

At present if a child is lost through over long detention in the womb the fault is laid to God and no one repines for the people are not educated to demand the termination of labor as soon as the child is mature.

If on the contrary forceps are used under proper conditions and definite indications and the child dies much criticism is aroused over the unwarrantable interference of the physician.

We all know that more cases of appendicitis have been lost through timorous temporizing than by the unnecessary use or even the abuse of the knife. So in obstetrics more babies are lost through overmuch reliance upon the uncertain and indifferent powers of Nature than by the intelligent and discriminating activities of a skillful attendant.

The induction of labor at term is at present practiced only by those especially interested in the solution of obstetrical problems but the technique is simple the judgment quickly developed and any intelligent man who is capable of doing clean surgery is competent to carry the maneuver to a satisfactory conclusion.

It is necessary however to consider as carefully as we may those objections to labor induction which have suggested themselves to us in the course of our work or have been urged against it by critics both friendly and otherwise.

The possibility of delivering a premature child brought anxiety to our earlier investigations when custom and general practice gave undue importance to such subjective incidents as amenorrhoea and the date of quickening. From our hospital patients who had only a vague recollection of the last period and none at all of the quicken-



to the sacrum is accomplished with surprising ease and without shock. The very limited bleeding is easily controlled with heat and pressure. Drainage is contra-indicated. In closing this artificial hernia it is well to imbricate the fascia of the external oblique so that the lower margin is outside and may be stitched as high as possible to get this line of sutures well above the dangerous area just below Poupart's ligament. The muscles exposed by the excision of fascia lata can be spread, dislocated and stitched so as to cover important nerve and to make a fairly complete floor for the skin to lie upon and from which to get an early blood supply. The importance of saving the long saphenous vein lies in the fact that the redevelopment of lymphatic vessels is thereby facilitated. In individuals thus operated upon heal surprisingly well and after a few months are without oedema even after prolonged standing. When the excision is bilateral a trypanadrome above the symphysis pubis and in the external genitalia is pertinent. In these inguinal operations also it has been our experience to find the introduction of catgut a guarantee of suppuration. Skin closure should be as indicated for the neck as the effect of the ray must also be safeguarded.

#### CONCLUSION

The criticism has been made so often that surgery is contra-indicated in many of the affections at any stage and in all at later stages that we wish again to emphasize certain points in the morbid physiology concerned which we believe to uphold the affirmative viewpoint since they have been confirmed by results obtained.

Early in these diseases while they are limited in extent proper surgical procedures effect a complete subtraction of the particular process concerned as is evidenced by permanent recovery. Somewhat later but while the resistance is still high extirpation approximately complete may lead to the same for

tunate result. Still later operative reduction of the amount of disease however radical it may be will of itself promote not more than a temporary improvement. It may no longer be claimed that the treatment of the diseases however early it may be instituted is completed in the operating room. It has only begun there and must be continued intelligently and accurately if each individual is to receive every opportunity to recover.

This squares with the conception that certain processes are malign for certain individuals because these individuals are incapable of responding to the irritant in question with a sufficient excess of local and general resistance. While it is possible though improbable that some form of passive immunity may later be developed to supply this deficiency, certain it is that no form of curative vaccination has an element of justification for its use.

Improvement can come only by an exact application of sound therapeutic measures in nature and in sequence dependent upon a growing knowledge of the living pathology of the disease and the morbid physiological responses it stimulates. Universal therapeutic failure and the testimony of postmortem pathology is evidence that prophylaxis and therapy have been at fault usually because antemortem pathology was neglected and not because the disease was incurable.

The philosophy expressed by W. J. Mayo must come to be accepted as the basis of judgment of method of treatment. The value of which is dependent not upon the immediate mortality rate in incipient cases but upon the larger proportion of recoveries produced in the more advanced. Moreover successful palliation a maternal prolongation of life in hope and comfort is perhaps as worthy an achievement as affecting a recovery and is as urgent a therapeutic obligation not only from the patient's standpoint but also because of the progress in treatment that can be made in no other way.

interference he could justly be charged with lack of training, courage and appreciation of his professional duty if not with a negligence that borders on the criminal.

What shall be said therefore of the obstetrician who allows the mother to be imperiled and her babe probably sacrificed through an overgrowth of the gestational parasite when its maturity could be readily recognized and the danger safely averted by the exercise of a reasonable amount of courage and skill.

If the obstetrician is competent and aseptic in his technique the woman and child are far safer when labor is induced at a carefully calculated maturity than when left to the watchful waiting policy of a timorous technician or to the care of a man who trusts to the decisions of an apathetic and indifferent principle of nature rather than to the more arduous and exacting activities of a discriminating human intelligence. The best apples are picked at maturity. They are not permitted to deteriorate from over-ripeness nor to be bruised by a fall to the ground through a decay of the pedicle.

Again the objection is made to our method of inducing labor with the Voorhees bag on the theory that the introduction of the bag changes the position of the head. If any one prefers another procedure such as the use of a vaginal or uterine tampon, a catheter or a Barnes bag let him work in his own way. We have no complaint. We can only report our own choice and our own results. Our statistics show that the ratio of the head positions to each other is quite close to the normal average which would not hold true if the head were greatly disturbed. If the head should become unsettled by the insertion of the bag the event seems to be of no particular consequence since it easily re-enters the multiparous pelvis as the bag descends while in primiparas the head is already so molded that in order to seize the path of greatest accommodation it must follow the bag down and resume its primary position.

The Voorhees bag is so flat on top that the head is not displaced or at least only inappreciably if the bag rests where it should—just below the vertex.

Of course the question of technical proficiency enters into the problem. Theoretically it would be possible to push the bag in too far and by such awkwardness or lack of dexterity to convert a vertex presentation into a face or even a complete transverse but it is not conceivable that such an event could happen where the hands are skillful and the technique of the procedure clearly envisioned.

In several instances where the head rested in an right occipito posterior position the attempt was made to lift it in the hope that it might come down in an right occipito anterior but except in two cases where the diagnosis could not be exactly defined the original conditions recurred.

The criticism is also offered by some one that the traction produced by the weight draws on the ligaments and pulls the uterus so far down that subsequent malpositions are probable.

This statement could hardly be made seriously by any one who was familiar with the pelvic conditions that precede labor. It is quite impossible to pull the uterus down unless the child descends with it and the head of the child is firmly held back by the pelvic bones. The induction of labor would be greatly simplified if the head and its muscular envelope could be brought down by traction on the bag.

Having properly given the advantage of primary presentation to the objections let us now in justice inquire why it seems desirable to induce labor at term in the absence of pathological indications.

Medical thought at present tends toward prophylaxis as an ideal. We strive to foresee and avoid pathology if possible rather than await its onset and then contend with an accomplished fact. This reasonable provision is called prudent prolepsis.

We must bear it clearly in mind that the commencement of labor is purely accidental and not dependent upon any known physiological factor. It must happen therefore that a certain percentage of cases does not go into labor at the appropriate end of the gestation period.

Now while it is no great disadvantage to the child for labor to occur a couple of weeks

ing we soon learned that it was impossible as well as unnecessary to depend upon such inadequate and unscientific data.

In the Vildfeld measurement of the babe in utero in the McDonald maneuver for determining the size of the uterus at term and in the Terret procedure for determining the biparietal diameters of the head from the easily accessible occipitofrontals we have a system of tests which readily preclude the induction of labor before the babe is duly prepared to combat the hardships of an extra uterine existence.

By the examinations the maturity of the child is competently established and the history of the last period and the date of quickening are relegated at once to their proper place as merely confirmatory incident in our calculation.

The use of these maneuvers is quickly learned their application gives the results astonishingly accurate and they should be taught in the schools and a universally employed in the routine examination of the patient in the last two months is the better known pelvic measurements. For a complete description of their aim technique and practicability the interested may be referred to a paper recently published by the writer in *SURGERY GYNECOLOGY AND OBSTETRICS*.

The second danger and the one most dreaded is infection. However as we showed in the report of our first series of cases this menace is more theoretical than real where the customary asepsis is observed. This position has been abundantly confirmed by the experience of other men throughout the country who are using the method.

In none of our cases has a temperature appeared that was not demonstrably due to other agencies than the induction. In our second series we have observed no temperatures over 100.5 F and these four in all were plainly attributable to breast conditions which subsided inside of twenty-four hours under the use of ice bags.

We have found every variety of micro-organism in the mucus made from the cervix and yet though the induction went on we have had no infections. This result is not to be

ascribed to chance but rather to the probability that the shortening of the labor process through the induction has enormously conserved the vitality of the mother and her resistance. Crile has eloquently demonstrated the injurious effects of exhaustion in the cerebrum and there is no question that mental and physical depression greatly diminish the immunity of the individual. When the first stage of labor is curtailed by the bag method the immunity is preserved and infection is extremely improbable.

We are not alone in our observation that many cases of protracted labor are followed by temperature even when conducted by clean men and with a minimum of trauma.

It is our belief that prolonged labors though non-operative are more disintegrating and more disastrous to the patient and more frequently followed by infections than extremely painful deliveries that are soon terminated. The human system sustains much pain for a short time far better than a lesser amount for a relatively long period.

Meddlesome midwifery is an alliterative charge that is solely and almost instinctively made against the induction of labor by those who respond congenially to the trammels of tradition. Wright of Toronto answers this imputation quite clearly. If says he

we can perform the operation in such a way that it causes no danger or at least very much less danger to the patient than the prolongation of the pregnancy involves then we must conclude that such interference is not only justifiable but advisable.

To the man midwife who wishes to hark responsibility the induction of labor at term will always seem meddlesome even though it is achieved not alone without injury but also when it means a distinct advantage both to the mother and child. On the other hand by the progressive obstetrician who does his work in a clean efficient way it will be hailed as the same kind of conservative surgery as an early or an interim appendectomy against which the same accusation of meddlesomeness was chorused some 60 years ago.

If a surgeon of today should permit an appendiceal abscess to pursue its wayward course unhampered by directive or operative

interference he could justly be charged with lack of training courage and appreciation of his professional duty if not with a negligence that borders on the criminal

What shall be said therefore of the obstetrician who allows the mother to be imperiled and her babe probably sacrificed through an overgrowth of the gestational parasite when its maturity could be readily recognized and the danger safely averted by the exercise of a reasonable amount of courage and skill

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before maturity there is a steadily increasing danger both to mother and child for every additional week of post maturity. The child continues to develop at the rate of 2 centimeter in length each week and proportionately in weight. This increase in size unnecessarily intensifies the obstetric problem and by raising the chances of operative complications greatly enhances the peril of the child and mother. An overlarge child is the exact obstetric equivalent for a contracted pelvis whose evil possibilities are recognized. The careful supervision of the pregnancy and skillful pelvimetry will enable the obstetrician to deliver at term a six and a half or even an eight pound baby, a baby that would have been lost inevitably if it went two or three weeks over term and then was dragged through the pelvis of a primipara with forceps.

Some idea of the frequency of overtime babies can be gathered from von Winckel's statement that 1 per cent of babies weighing more than eight and one half pounds are post mature. The labors in these cases are not infrequently prolonged and difficult. It is well known furthermore that many of the post mature babies die in utero before the onset of the belated labor while the not unusual infection and mutilation of the mother bring about a protracted if not permanent disability. If this is true as we believe then the traditional policy of watchful waiting which was an element of safety in pre-antiseptic times now becomes in every way of responsibility that is unjustifiable.

By a judiciously timed induction the contractions of labor may be inaugurated when the baby is mature but not too large to pass the pelvic canal without extreme difficulty and without operative trauma. The mother is spared from four to eight hours of suffering, she rises from her confinement unexhausted and with her immunity unimpaired. A minor feature also but not undesirable is the assurance that her gestation will end on a certain fixed date. This relief is usually financial as well as mental. Moreover neither the patient nor the physician is caught unawares. There is no fire alarm trip to the hospital at some uncanny or inconvenient hour but with the same equanimity and control that

attends any other non accidental surgical procedure the contractions are started in the morning the labor advances in a cleanly surgical way and terminates in the afternoon or evening smoothly and happily for mother and babe for family and attendants. Under such conditions of election it is easily possible and also convenient for the physician or his skilled assistant to give the patient the time and attention which all labors demand and few receive.

In brief a scientific control of the labor from the very beginning replaces the watchful waiting of the midwife and puts the patient where she really belongs in the domain of clean surgery.

Our choice of the Voorhee bag in our work is based on its satisfactory shape its construction of fabric rather than rubber and its physiological effect. The bag not only imitates the pain dynamically but it acts mechanically to dilate the os and to check hemorrhage. While the bag is in place the child is protected against injurious pressure when it expelled the pre-empting part begins to advance and the labor is soon over.

With the lengthy but necessary preamble the result of our second series of one hundred cases may be given preceded however for the sake of those who have not happened to see our first paper by a resume of the technique of bag introduction. We may say in passing that this technique has not been altered or amended although one precautionary bit of advice may be offered. When the membranes are accidentally ruptured by the insertion of the bag no attempt should be made to pull on the bag to mark its advancement lest it come out and by the suction developed bring down the cord. Let the pains expel the bag and the pre-empting part will follow normally and gently into the pelvis.

The patient's bowels should receive attention the night before and in the morning careful obstetric preparation is given to the external genitalia. Then under strictest asepsis a Voorhee's bag is introduced without rupturing the membranes. The following technique is observed.

Assemble and sterilize by boiling 20 minutes a Voorhee's bag No. 4 a Simon speculum

or vaginal retractor a pair of long Pean for  
ceps pairs volsellum forceps 1 dressing  
forceps 2 pairs compression forceps 1  
Goodell dilator 1 tenaculum forceps a hand  
bulb syringe with glass tubes and rubber  
connections for the bag

The patient prepared as for delivery is  
placed upon the table in exaggerated lithot-  
omy position Stirrups will serve

The vagina is retracted a smear made from  
the cervix and the mucous membrane wiped  
clean with pledgets of gauze on forceps  
Anesthesia is only occasionally necessary  
even in primipara

Before using the apparatus must be tested  
by forcibly filling the bag with sterile solution

One lip of the cervix is seized by the vol-  
sellum forceps and brought down Usually  
even in primipara the os is sufficiently pat-  
ulous to admit the bag if not dilate

The bag is emptied of residual air and fluid  
and the flat end pulled out It is now rolled  
up into a compact mass like a cigarette and  
seized with the Pean forceps so that the tips  
extend just to the largest diameter of the  
rolled bag Anoint the bag with sterile glyc-  
erine turn the concavity of the forceps  
toward the patient's left leg and introduce  
As the bag enters turn the mass to the  
operator's left—a quarter turn—so that  
when the operation is completed the con-  
cavity of the forceps looks upward Release  
the lock on the forceps Connect the tube  
with the syringe and force the sterile solution  
slowly into the bag Do not overfill by  
force or the bag will break Tension on the  
tube of the bag or resistance to the injection  
of fluid are signs of fullness to the experienced  
operator If uncertain of the technique a  
measured amount of fluid may be used A  
piston syringe of tested size will also serve  
to inform the operator when the capacity of  
the bag (6 ounces) is reached The Pean  
forceps are removed as soon as the bag fills  
enough to prevent its slipping out Remove  
volsellum The tube with tape when the bag  
is full and disconnect the syringe Put a  
sterile pad on either side of the tube Re-  
move the stirrups and straighten out the  
patient in bed If the bag breaks or being  
insufficiently filled is expelled within an hour

the pains will sometimes go on without further  
irritation of the cervix if they do not an  
other bag should be introduced

If the pains do not start within an hour  
or if compression is desired as in placenta  
previa or a more rapid dilatation then a  
weight of one or at most two pounds is  
attached by a tape to the protruding tube and  
passed over foot of the bed Usually in from  
five minutes to half an hour contractions be-  
gin and labor has been inaugurated just as  
one would start the pendulum of a clock

In a variable period rarely more than four  
hours—three hours and nineteen minutes  
was the average in this series—the bag is  
expelled by strong pains the dilatation is  
practically complete the head follows the  
bag down the membranes rupture and the  
second stage begins From now on the case is  
managed according to general obstetrical  
principles If the pains are weak and shallow  
pituitrin may be indicated if strong and reg-  
ular morphine and scopolamine or gas or  
chloroform may be added The tedious  
exhausting and painful first stage has been  
materially shortened and definitely controlled  
The bag acts as a dynamic stimulant to the  
contractions as well as a mechanical aid to  
cervical dilatation and it preserves the mem-  
branes from injurious pressure until physio-  
logical rupture occurs If the membranes  
have been ruptured when the bag was in-  
serted it is good practice to make an internal  
examination when the bag is expelled to  
determine the presence or absence of a  
prolapsed cord It has a good effect also to  
lift the weight at half hour intervals and ob-  
serve the effect on the pains

In the present series there were

Primiparae 51 multiparae 40 The average dura-  
tion of labor was 8 hour and 5 minutes This  
figure is greater by 53 minutes than the average  
in the first series but it may possibly be accounted for  
by the presence of 16 more primipara in this series

The longest labor was 28 hours the shortest one  
hour The shortest labor in a primipara was 1 hour  
and 23 minute

The bag broke during or shortly after insertion  
three time but it was reinserted only once The  
membranes were ruptured by the introduction of  
the bag five times In one case of hydramnios it  
was intentional

There were no maternal deaths

The average weight of the babe is pounds and ounces not including the placenta and the umbilical cord. Among the babies were boys and girls. The delivery was by cesarean section on the fourth day respectively. The child lay on its back on the table and the head was in the tenth position. One of the cases was a normal delivery and the other an instrumental delivery. The head was in the perineum when the heart was first heard. The first period was quiet.

The position were left occipito anterior and right occipito anterior. The breech was at the feet.

For the purpose of time to have a list of the patients. The results were as follows: In the first case the placenta was delivered on the fourth day. In the second case the placenta was delivered on the fifth day. In the third case the placenta was delivered on the sixth day.

The average time for the expulsion of the placenta was 3 hours and 20 minutes in the previous series. The longest time was 5 hours and the shortest 2 hours.

The results were as follows: In the first case the placenta was delivered on the fourth day. In the second case the placenta was delivered on the fifth day. In the third case the placenta was delivered on the sixth day.

In all cases but two the results were applied after the introduction of the bag. The traction being just sufficient to keep up the delivery.

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Five cases required few stitches. The results were as follows: In the first case the placenta was delivered on the fourth day. In the second case the placenta was delivered on the fifth day. In the third case the placenta was delivered on the sixth day.

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In this series of cases it is extremely gratifying to report that the favorable opinion of the method which was formed during the first series is not only confirmed but strengthened. No objections to the method have been raised

hitherto that can be validly sustained among scientific men.

Our observations up to this time lead us to believe that the bag can be used freely and harmlessly both in primipara and multipara and in normal as well as in pathological cases. It removes and overcomes the principal obstacle in a majority of labors — the undilated cervix — and leaves us only the bony pelvis as an obstruction and this too in a patient whose strength is as yet unimpaired and a babe of reasonable size.

The most difficult cases we have to contend with are the multipara with much cicatricial tissue in the cervix and primipara where the same part is thick and hard. These are intractable conditions under any circumstances and it is probable that our experience in the future will show that such women have far more satisfactory labors with the bag than without it. Moreover these cases are close to pathology and should be considered separately in the class with contracted pelvis.

As we said in our first report the highest advantage of our procedure lies in the fact that the course of labor is entirely under the control of the obstetrician from start to finish. There is no timidity, indolence or dubiety. The day is appointed the cervix is dilated slowly or quickly the contractions are strengthened or weakened the pelvis enlarged or let alone. Complications are boldly met or foreseen and avoided the labor is hastened or prolonged the pain permitted diminished or abolished according to the judgment of the operator. The process works in strict harmony with the principle of modern scientific surgery.

## THE PROBLEM OF THE RECONSTRUCTION AND RE-EDUCATION OF THE DISABLED SOLDIER<sup>1</sup>

By MAJOR ROBERT W. LOVETT M.P.C. U.S.A.

**A**PPROXIMATELY 1 year ago the United States entered the European War. During that year hundreds of thousands of young men have left their homes, their people and their occupations and have entered the service of the United States to fight its battles. These men were not only in the most active and vigorous period of life but having been examined for physical soundness before entering the army they represent a highly selected class of sound active individuals of great value to the community.

The experience of Canada has shown that out of every million men sent overseas 100,000 or 10 per cent. will have within one year been sent home as unfit for further military service. Of the 100,000 thus sent home 80,000 will be able in most instances to return to their former occupations. The other 20,000 will have been so badly disabled that they cannot return to their former trade or occupation and must be partly or wholly re-educated to some new one.

The governments at war recognize their responsibility to return these men to civil life in as nearly as possible the same condition as that in which they were taken from it. It may be possible to return them on a higher level of economic value or it may be on a lower level but it has been definitely established that each government concerned will do its utmost to restore to each disabled man the highest degree of economic efficiency attainable not as an act of charity but as a discharge of a legitimate indebtedness. The present address deals with the means by which this is to be accomplished.

The problem concerns the public in two ways. First there are few homes where some near or distant relative or friend is not or will not be in the service and second the success of the movement to be described here must depend finally upon sound public sentiment and the education of the public to an appreciation of the character and gravity of the

problem to be met. For this reason before discussing the specific question of ways and means something must be said of the proper attitude of the public toward these returned disabled men. Those soldiers who return without an arm or a leg or with a disabled or useless limb are not to be regarded as poor cripples to be commiserated and set apart as unfortunates whose usefulness is ended. They will not in the future be compelled or allowed to sell lead pencils or boot laces on the street corners as their most suitable occupation. They are rather to be regarded as public spirited citizens who have incurred some physical disability in the pursuit of their service to their country, a disability to be regarded as a badge of honor rather than as a physical defect. This disability in most cases can be in greater or less measure compensated for by proper treatment and training and in many instances the disabled man will find himself in a position to earn better wages than ever before in his life. To substantiate this somewhat optimistic point of view one may quote briefly French and German experience.

The loss of an arm of course constitutes a more serious problem industrially than the loss of a leg. At the school at Lyons toy making and parts of bookbinding are taught to one armed men. At Montpellier wood turning, tailoring and boot making also proved available. Of other occupations for such men are basket work, drawing, horticulture, telegraphy, clerical work, stenography, etc.

With regard to the loss of a leg, the experience of the English Soldiers and Sailors Help Society is of importance. They consider 'that the loss of one leg does not debar a man from being quite as useful as he would be with two legs provided a little care is taken with him in the early stages and we consider that if we were to take two men, the one having all his limbs and the other minus a leg we should



be more successful with the man minus a leg than with the able bodied one for this reason that the man with one leg realizes that he is not quite so useful as the other man and therefore lays himself out to be as useful as he can possibly manage to be. We can arrange suitable work for men who have lost both legs. It is only a matter of getting a man onto his bench or into his chair each morning.

The attitude of regarding these disabled men in any way objects of charity is wholly improper and unjust and should be condemned. They have earned the right to every care, every privilege and every assistance that we can give them. They have fought our battles at the front during the war and we should regard it as our privilege to fight theirs at home after it. Nor should there be too large an element of sentimentality and emotion in dealing with the problems mentioned. Heroes these men are but they will be better served in the end if the public regards them rather as men whose wage earning capacity has been impaired men to whom it is due that every effort be made to make the diminution as little as possible.

In one of the allied countries the wife of a returned soldier complained to the representative of a patriotic relief agency which had been attending to the family needs while the chief breadwinner was at the front that her husband would never spend any time with her or the children. She had wanted that afternoon to have him accompany them to the park but he disdainfully refused saying that he was going out for an automobile ride and later to a sing song at one of the fashionable hotels. The musical entertainment referred to was being provided by the society ladies of the city.

This problem of the attitude of the public and of educating it to better things is of very great importance because the cripple of the past has been regarded askance as a poor unfortunate greatly to be pitied to be stared at in public and petted and spoiled in private. This attitude is well presented in a novel which was in vogue some years ago called

*Sir Richard Calmady* by Luca Malet where the crippled hero's disability and peculiarities are harped on and discussed dwelt on at every turn and his life is centered around his peculiarity which is constantly emphasized by all those about him. So well does it embody all that we ought to condemn that I have often asked classes of medical students to read the book in order to learn what attitude to avoid.

Take rather as a model of what is desirable the attitude of a young woman of twenty six who appeared at a recent orthopedic clinic held in connection with the Army Medical School in Washington whose story only came out when she was questioned in the amphitheatre. She had been injured in an automobile accident six years ago when an overturned car had pinned her beneath and had fractured her spine. An unsuccessful operation had been performed and since the day of her accident she had been wholly paralyzed from the waist down. For the first year she had been treated but for five years nothing had been attempted. With casters put onto an ordinary kitchen chair she had managed to do the housework for a family of five. She had done the cooking, made bed, swept, scrubbed, cleaned, painted, washed windows, done some gardening and had so far as I could learn done all these things without a thought of commiserating herself or asking for sympathy or assistance. Some friend had insisted on her coming to the clinic. Contrast this healthy minded attitude with the morbid shrinking, self indulgent, self conscious attitude so often possessed by the cripple and see what a great advantage there is in inducing people to adopt the healthy and sane rather than the morbid and commiserating view toward these returning soldiers.

So strongly do I feel the disadvantage of dwelling too much on the term cripple that in this address it will be my attempt to avoid the term crippled soldier so much in vogue in the newspapers and to speak only of the disabled soldier.

Having thus considered the point in which the matter should be approached we may come to the closer consideration of the problem itself. The term most often applied to

meet the situation and perhaps the best is *Reconstruction*. The word reconstruction is also applied to the repair of the devastated regions in France and Belgium such as the rebuilding of villages the refurnishing of farms and houses the replanting of orchards etc. which activity is perhaps equally entitled to the use of the word reconstruction but this double use leads to confusion and confusion will in the end prove detrimental rather than beneficial to both interests.

In this instance the term reconstruction will be used to designate the attempt to rehabilitate and if necessary re educate the man who has been physically disabled. This attempt will fall into three divisions which are almost self evident. First the returned soldier must receive medical and surgical attention to determine whether he needs further operation and if he does he must have it performed. Second many of the men with surgical injuries require treatment to loosen up joints develop muscles free tendons improve resistance to fatigue and although this is partly accomplished by massage and similar measures it has been found in this war that it is better brought about when possible by actual work either in bed *bedside occupations* or in shops equipped for the purpose known as *curative workshops* in which an occupation is pursued which is of itself curative. Third the disabled man must in a certain number of instances be educated to a new trade or occupation inasmuch as he may be unable to follow his original one on account of the nature of his injury and here comes in the third stage of reconstruction activity spoken of as vocational training or re education.

The stages of reconstruction may be tabulated as follows

R	Medical treatment									
	tru	t	Th	pe	t	mea	{			
	v	l	t	g	pl	t	m	t	d	ill

The whole question of reconstruction in this paper will be discussed largely from the point of view of the orthopedic surgeon not because it is the only point of view but because it is the one with which the writer is most familiar.

*Care of cripples*. At the beginning of the war in 1914 most of what we knew about the possibility of restoring usefulness to the disabled we had learned from our attempts to help the cripple or the crippled child whose functions had been impaired by disease or accident or by some congenital defect. Industrial schools and homes for cripples had been founded societies in Germany and America had been formed for the study of the question and two journals one German and one American were devoted to the consideration of the subject. Up to 1832 the cripple had been wholly neglected as a public problem but in that year the Royal Bavarian School and Home for Cripples was started. America took no effective action in the matter until some sixty years later when a private educational and industrial school for cripples was started in Boston. That was in 1893 and represented the first American attempt at re education along useful lines although there had been founded three homes for crippled children in the preceding few years.

When it came to convincing the public that the state care and education of cripples was advisable necessary and economical it was surprising to see what public inertia one encountered. The blind the feeble minded and the deaf mutes were recognized as proper subjects for state aid and instruction but to one who was concerned in an attempt to convince the Massachusetts legislature that cripples were entitled to similar advantages the unwillingness to take seriously the question was surprising but although in the end the fight was won only four states have provided such state care and education. Minnesota New York Nebraska and Massachusetts founded such schools in the order named between 1897 and 1906 inclusive.

*Industrial cripples*. The care and rehabilitation of the man crippled in industrial work was never considered in America a public problem and he has been from the outset neglected and a great economic error has thereby been committed. However that will never occur in the future for the lesson of what may be done in restoring the disabled soldier to usefulness is already being taken seriously in the industrial world in its applica-

tion to those injured in the industries a matter which will be discussed later

Taking the situation as it existed in 1914 we had learned from the study of the attempt to improve the cripple that his mentality and outlook were unfavorably influenced by his disability that he was uneducated in a surprisingly large proportion of cases being wholly illiterate that trade and wage earning occupations were often closed to him in his uneducated condition but that in many instances by proper surgical attention by general education and by special training he could be made a wage earner and a useful citizen instead of being a burden on his family or becoming an almshouse charge. The patient with paralyzed legs and consequent inability to get about actively is just as useful as any other citizen whether a farmer, worker or a designer. A girl with paralysis of both arms in the Massachusetts Hospital School at Canton Massachusetts was taught to use her feet as hands and in a sewing competition among the town pupils won first prize for her sewing and embroidery. A baseball nine was formed at this school and in a series of games in which the school leagues one summer this team won two games out of every three played in competition with healthy boys of their own age. The catcher had two artificial legs and his base running was done for him by a boy with useless arms but good legs. Thus through the nine the job was adapted to the disability of the individual. We had learned that the individual within proper limits could to a large extent be educated on new lines and that to a certain extent the job could be adapted to the individual.

In England an attempt to salvage disabled soldiers was begun after the Boer war and workshops were established by the Incorporated Soldiers and Sailors Help Society in London which after the death of Lord Roberts were called the Lord Roberts Memorial Workshops. The object of these shops was to teach useful trades to men discharged as medically unfit who by reason of their disability are unable to take ordinary employment and to make such cases as far as possible self supporting.

There should be added to the knowledge

existing in 1914 derived from the study of the cripple and from the experience of England just mentioned a small amount of information from a few schools for those injured in industry such as that at Charleroi under M. Bisqueux who put this experience into use in the Ecole Joffre in Lyons.

With this stock of knowledge England and Belgium started in soon after the beginning of the war applying the facts thus learned to the repair and re education of the disabled soldier. This attempt has been attended by very marvelous results and in this country we start in with the great advantage of being able to draw on the experience of the nations in meeting a problem similar to the one that now confronts us. The data here presented are necessarily derived from the experience of these other nations.

The keynote to the whole situation seems to be that man is an adaptable animal mentally and physically that in his daily routine he is probably using but a small part of his real capabilities that his life occupation is not necessarily the one for which he is best fitted and that he is often not educated up to his regular job. If therefore a man is so injured that he cannot return to his old work the question arises as to what work he is physically and mentally fitted to perform and among such jobs which one attract him. Moreover a little education might help him to a better job within limit than he had before. We can count on adaptability as enabling the intelligent man to adapt himself to his work so that the work need not wholly depend on being adapted to the man.

*Proress of the soldier* To take up now the specific problem to be discussed we must start with the soldier's injury. The man who is wounded in action receives his first surgical attention from the regimental or battalion surgeon at the first aid post generally situated in a dugout a few hundred feet behind the first line trench. Conditions are not favorable at this place for more than first aid. He then either walks or is carried through the communicating trenches to a point about a mile back where he is placed in a motor ambulance and carried to the field ambulance dressing

station about three miles back of the front line trench. Here he receives an inoculation against tetanus his wound is redressed he is given a hot meal and is carried on in a motor about five miles farther to the casualty clearing station. Here he receives his chief surgical attention he is X-rayed if necessary operated on if need be perhaps redressed put in bed nursed fed and cared for until he is able to be transported by train to the base hospital a journey of some hours and in this base hospital he can be kept as long as need be. In general it has not been found advisable in Canadian experience to keep a man in Europe over three months. A man obviously permanently disabled is generally returned home in about two months while doubtful cases are retained about three months to see if they are likely to be able to return to active military service. From the base hospital he either returns to the front after perhaps a stay in some convalescent home or he is invalided home as probably or manifestly unfit for further active war service.

With regard to the number of men who are returned to the front for active service from the base hospitals in the year ending April 1915, the Germans claimed from 87 to 91 per cent. Data made early in 1917 by a Copenhagen society give for the central powers and allies about 70 per cent to be returned to the front. It is stated in a military periodical<sup>1</sup> that in the battle of the Somme there were some 2600 wounded British each day of whom 83 per cent returned to active duty. Well informed authorities regard the German claims as quite exaggerated while others would place the figure at 80 per cent or higher on the Western front for both allies and central powers. The fact is that there are as yet no reliable data available on which to base an exact estimate but there is no great doubt that more than half of the wounded who reach a base hospital are capable of returning to duty in a few weeks. An English estimate<sup>2</sup> gives the following percentages. In the so called command depot at Heaton Park within a period of six months from the date of injury

about 50 per cent rejoined their original units 15 per cent were sent to service in communicating lines abroad 15 per cent were useful for sedentary occupations at home and somewhat over 20 per cent were discharged as permanently unfit many of these having been untreatable from the outset Of the men thus invalided home Belgian experience has shown that 80 per cent are capable of vocational re education while 20 per cent must be regarded as permanently incapacitated for wage earning activity on account of the nature of their injuries Of those who are suitable for re education 45 per cent can be made to earn their normal wages 30 per cent can be partially restored and can earn an appreciable wage while 15 per cent can be repaired to an extent to earn a salary which will constitute a bare livelihood

*Method*—On the arrival of the soldier at a home port he is either discharged permanently to his home after examination or is sent to a reconstruction hospital after a short furlough at home which has been found desirable when it is practicable and the soldier is able to travel. This conduces to a better mental attitude and greater content. The men discharged permanently are those who are unfit for further military service and who are not in need of further surgical or therapeutic attention, most of whom are able to pursue their former lines of work without re-education.

Of the returned men 75 to 85 per cent are to be classed as orthopedic. The definition of orthopedic as established by the ruling of the Surgeon General of the United States of August 1917 a ruling which is in general accord with the English and Canadian classification is as follows: (a) derangements and disabilities of joints including ankylosis (b) deformities and disabilities of feet (c) malunited and ununited fractures (d) injuries to ligaments muscles and tendons (e) cases requiring tendon transplantation or other treatment for irreparable destruction of nerves (f) nerve injuries accompanied by fractures or stiffness of joints (g) cases requiring surgical appliances.

With regard to the various forms of afflictions which have disabled these men in an analysis of about 3000 Canadian returned men

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expense even after discharge. If he refuses training half of his pension may be withheld. During training he is paid as if he were totally disabled and his family receives the same allowance that they would if he were dead.<sup>1</sup>

It would seem as if uniformity of conditions in treatment and re-education were better insured by government control as the soldier is then in the hands of specialists controlled by the medical department he is associated with other men similarly handicapped and his tendency to self-commiseration is thereby diminished and he is far less likely to mental demoralization than if he were turned loose to be cared for by private charity administered in civilian institutions.

The advantage of standardization of morale and methods is great and this would imply that if government control of these men is to exist they must be treated in military hospitals and that civilian institutions could not be used unless wholly turned over to the government for the purpose because the utilization of civilian institutions would mean civilian control of men in service or a divided control. The possibility of the former can perhaps be only appreciated by those who have seen the returned men under these conditions. After months or years of hard exacting work they find themselves idle and disabled with their future to a certain extent unsettled. They resent the idleness they are inclined to be mentally unstable and unruly, and at no time in their career do they need a firmer hand than during their early convalescence. A civilian institution filled with such patients would be a constant state of ferment unrest and inefficiency. With regard to dual control of such institutions that was tried out in Canada where the hospital's commission, a civilian board and the medical corps shared equally in the control of the reconstruction hospitals. The disadvantages of the scheme were such in the way of duplication of all administrative machinery that after one or two changes a scheme has recently been adopted by which the whole matter has been placed in the hands of a new department of the Government of Canada known as the

Department of Soldiers Civil Re-establishment over which a Minister of Soldiers Civil Re-establishment presides. The duties of the department comprise the providing of hospitals convalescent homes and sanatoria, the vocational education and other training and all matters relating to pensions of disabled soldiers.

Civilian institutions are naturally anxious to be of use and much pressure has been brought to bear on the government to use such institutions but it would seem that the best results were to be obtained if returned disabled soldiers remain in the army and are not discharged until their treatment has been nearly or wholly completed and that this should be carried on in military institutions under military control so far as proves practicable. It will often happen that the man's treatment and vocational training must go on contemporaneously. His status under these conditions will have to be determined in each individual case but the weight of opinion is to the effect that treatment will be more effective when carried out under military control.

To return to the program of the individual soldier. At the conclusion of his furlough or if no furlough is practicable the returned disabled soldier is sent to a reconstruction hospital and it is important that idleness should be terminated as soon as may be. Here he is carefully examined his disability investigated and analyzed his needs formulated the question of an operation to improve his defect considered and if necessary performed. After this the question of his treatment is considered. If he requires an artificial limb his stump is prepared for its application. Very often the joint of the hip for example has become stiffened in a position which makes it difficult or impossible to use an artificial leg.

The artificial limb question has been settled by Canada by the establishment of artificial limb factories administered by the Government where such appliances may be turned out of standard pattern at a cost much less than that asked by the commercial manufacturers. These limbs are fitted under the supervision of the surgeon and the patient instructed in their use.

If stiffened joints exit the question of their mobilization arises by operation or therapeutic means. Analysis is analyzed and the possibility of the restoration of some degree of nerve power discussed. Uker from wounds badly united and ununited fractures and similar disabilities are placed under proper treatment and operated on it need be.

Before discussing the strictly medical and surgical aspect of the treatment something more must be said of the psychology of the disabled soldier. He has been living under discipline under great stress and excitement at times he has been under orders and has not had to think for himself when suddenly he finds himself partially or wholly disabled his former occupation can perhaps no longer be carried on he has a family dependent on him and his future is uncertain he is inactive and perhaps has to remain in bed for weeks. He must not be clased with the ordinary hospital patient he has special needs he may be unable to read or not interested in being read to while for games or cards he may have no aptitude yet he must be given some occupation and here comes in the usefulness of the so called bedside occupation which should be begun as early in his career as possible.

The so called bedside aides here find their usefulness in teaching simple and useful occupations to them. The teachers themselves will have to be trained in many or most instances but it takes a short time to learn enough of basket making knitting block printing weaving (hand looms and bead looms) etc. to teach a man who does not know the first rudiments of such thing. In this line of work comes the first introduction to vocational training and it serves a useful purpose in occupying the man in the manufacture of something which can be used by somebody and immediate improvement in morale is often noticed.

The attitude which the public should take toward these men has already been spoken of but not less important is the attitude which such a man should take toward himself. Self pity is demoralizing and detrimental courage and self reliance and unity cannot be taught by lectures but in the helpful stimulating attitude of those who come into con-

tact with these men in the early days of their reconstruction. Such help should begin as far back as the base hospital where the mental needs of the soldier should be met and occupation if possible provided. During the voyage he should have some such cheerful companionship and occupational therapy should be at hand to prevent mental demoralization.

#### PHYSICAL THERAPEUTICS

The therapeutic measures at our disposal which have proved useful in such injuries in civil life in the past and have shown their value in war conditions are as follows:

1. *Massage* is used to restore tone to the muscles stimulate local circulation to loosen up scars and diminish swelling and for this need we must educate competent operators. It is responsible business and not to be handed over to every person in civil life who calls himself a masseur. A school must be established for the training of competent operators a standard of excellence must be decided upon and the soldier must be protected against careless and perhaps harmful manipulation.

Medical or therapeutic *gymnastics* must be given with a purpose of improving the general condition of increasing resistance to fatigue of loosening up stiffened joints of improving the strength of weakened or paralyzed muscles etc. They have been long recognized as effective and in war conditions have proved of the greatest value. They must however be given with care skill and judgment by competent operators.

3. *Mechanotherapy*. Another department of physical therapeutics would consist of what would be called mechanotherapy used chiefly for the mobilization of stiffened joints and development of weak muscles where machines of greater or less complexity are used instead of manual stretching and manipulation. The pendulum principle has been extensively used the rhythmic swing and graduated force being effective. Simple apparatus devised by certain men to suit their own needs and complicated ones are of the type of the Zander apparatus.

4. *Hydrotherapy*. In physical therapeutics would be included hydrotherapy or water

treatment by baths douches sprays etc which are of use in promoting local or general circulation removing local congestion and thickening and stimulating the general condition

5 *Electricity* Treatment by electricity or electrotherapeutics has shown itself to be of value in nerve injuries local muscular weakness or paralysis and similar conditions

6 *Heat* The use of hot air and radiant heat from gas heated ovens and from electric light bulbs has long been known to reduce local congestion and swelling to allay local pain and tenderness and to diminish along with the other measures mentioned joint stiffness

7 *Games* There may be grouped in this division of physical therapy the use of games fencing bowling and similar exercises to improve the general condition and to mobilize partly stiffened joints

8 *Muscular re education* Muscular re education or functional re education of the physical therapeutic measures is the last to be considered Here the attempt is made to teach muscles to resume their normal functions wholly or partly lost by injury or by so called shell shock Long recognized as of value in the treatment of paralysis it has assumed especial importance in the treatment of the returned soldier and has been particularly elaborated and formulated by Prof F A Bött of the University of Toronto<sup>1</sup>

*Curative workshops* The value of the measures mentioned under physical therapy cannot be overestimated and have been demonstrated as never before in the case of the disabled soldier but these measures possess the disadvantage of monotony they have no definite use beyond the improvement of the individual and carried out over a long period the soldier loses interest and becomes stale The tendency has therefore of late arisen to substitute for them some occupation by the performance of which some of the same aims may be accomplished and this introduces the question of the curative workshop which has assumed great importance The introduction to the curative workshop has been offered to many of the soldiers by a pre-

liminary use of bedside occupation The curative workshop represents the most important and the newest feature of the second phase of reconstruction You will remember that the first phase concerned itself with surgical repair by operation or treatment or both The second phase opened with bedside occupation already described to which succeeds the curative workshop which completes the second phase The third stage not yet taken up deals with vocational training These stages overlap and are naturally not wholly distinct They are repeated here in the hope of making a new and rather complicated matter a little plainer

Sir Alfred Keogh K C B formerly Director General of the British Army Medical Service speaks of the curative workshop as follows

Nothing has been more remarkable than the overthrow of the old fashioned purposeless orthopedic exercises for the cure of muscle weakness stiff joints etc Under the influence of Colonel Sir Robert Jones C B useful manual work has largely supplanted the older system of mechanotherapy The bench of the workshop and the gymnasium provide for the active movements of joints and of limbs in contradistinction to the for the most part passive movements of the appliances hitherto in use while at the same time the patient being provided with a useful occupation lends himself more readily to the treatment prescribed for him and becomes interested in it The chief point to remember is that each piece of work performed is a prescription ordered by the surgeon for a specific joint or muscle disability

Colonel Sir Robert Jones Inspector of Military Orthopedics who is in large measure responsible for the development of the curative workshops says As soon as the patient is fit to get about he should have some occupation both for his mental moral and physical welfare Here the curative workshop is an invaluable aid to his gymnastic treatment

Excellent and useful as systematic gymnastic training is for developing movement the training in co ordination in doing purposeful work is what really brings brain



and muscle once more into proper accord while regular daily work re-establishes in the patient habits of responsibility and self respect.

For example, a man with stiff fingers barely able to grasp even fairly large objects is soon utterly wearied if set to grasp spring dumb bells or any other such apparatus but will cheerfully spend the morning grasping a big duster and cleaning windows.

Later if he is a carpenter or other skilled tradesman he is promoted to the use of tools he understands and so the disabled is re-educated partly by set gymnastic exercises and largely by work. Drivings a plane in the carpenter work can be employed for exercising muscles and joint in both arm and legs.

His brain is interested in what his hands are doing and not wearied by the curative action which the trade brings about.

In the choice of the special department of the curative workshop to which the man shall be first assigned depend almost wholly on the therapeutic needs of that man. It may be that he requires only occupation for his general physical and mental condition to enable him to rest fatigue better to improve his circulation and muscle tone. For such men it matters little which of the division of the work they take up but in general it is obviously desirable for them to take up some occupation which would be preliminary and introductory to their vocational training. If the man on the other hand has stiff joints or shortened muscles then his assignment in the curative workshop must be made with much care. The most common trades used in such shops are carpentry metal work the use of lathes leather work cobbling tailoring net making basket making, drafting, etc.

In cases where the curative workshop is used mainly for loosening up joints and muscle the application would be much as follows. If the wrist is stiff and the circulation of the hand poor the use of a carpenter plane is prescribed which will necessitate the use of both fingers and hands. The stroke at first will be short but as it is lengthened it exercises more effect upon both wrist and fingers. If pronation and supination are limited the board to be planed may be tilted more and more which exercises a new line of force. If

the elbow is stiff the patient starts using a saw with a short blade and the length of the saw and the length of the stroke are gradually increased to exercise more force upon the stiff elbow. Other carpenter's tool of use for their corrective effect on arm and hand are the gimlet or screwdriver the bit stock etc. Basket work and net making are excellent for loosening up stiff fingers. For stiff ankles and knees pedal driven fret saws foot lathes or foot driven machines of almost any nature mobilize the joints of the lower extremity. In the curative workshop utilized only as such there need be very few trades carpentry being the most generally applicable and the material output is not important because the main object is therapeutic. The curative workshop is situated in the reconstruction hospital and is more closely affiliated to the medical than to the vocational aspect of the work because its use is to replace and supplement such measures as massage etc. which would naturally come into the medical division. In general the medical division of the work would run through the curative workshop and in the period of vocational training the vocational adviser would be in charge. But there must need be overlapping and the vocational trainer would probably have the technical administration of the curative workshop to carry out the prescriptions of the medical officer. The medical officer would naturally be consulted as to the man's capacity for one or another form of vocational training. In this overlapping would be found common ground for both medical and vocational experts.

As to the size of the problem of vocational re-education the estimate of the Federal Board of Vocational Training in their report of February 1918 are as follows. The latest report of Canadian experience states that practically 10 per cent of the Canadian forces overseas have been returned as unfit for military service. Of the men returned unfit for military service 80 per cent or four fifths return to their former occupation without vocational training and 20 per cent require vocational training. On half of those requiring vocational training require complete vocational education and one

half partial vocational re education. Accepting these ratios is significant for the overseas forces of the United States and assuming that the United States will send over 1 000 000 men the first year and will increase its expeditionary force by 1 000 000 each year for the duration of the war. The following deductions are perhaps warranted as forecasting conditions at the close of one year of fighting.

Number of men overseas	1 000 000
Number of men returned unfit for military service	100 000
Number not requiring vocational re education	80 000
Number requiring complete vocational re education	0 000
Number requiring partial vocational re education	0 000

In a word for each million men overseas it may perhaps fairly be expected that 100 000 men will be returned each year of whom 20 000 will require complete or partial vocational re education. This number of men may in fact be in hand to be provided for by the close of the summer campaign of 1918.

It is evident therefore that the question of vocational training must be taken up on a large scale and first one must consider certain aspects of the matter which seem fundamental. These are: (1) The new trade should be so far as possible affiliated to and like the former occupation. Instances of this would be where a house painter would become a sign painter, a barber a wig maker, a mason or a carpenter a draftsman or architect's clerk. The house painter with disabled legs would make a poor wig maker and the barber a poor sign painter. A mechanic was earning three dollars a day before the war and was disabled. He was given a course of ten weeks in mechanical drawing and now earns twice as much. (2) The new occupation if it cannot closely resemble the old one should be one adapted to the individual's capacity and education. This is less important than it might seem because the experience of a year in Belgium has seemed to show that the choice of the original occupation was usually haphazard (De Paew). As examples of this change of occupation a waiter whose right arm was disabled took up sign painting with his left hand and in six months became a

master workman. A clown disabled for the leg became a most successful ornamental printer. A man before the war had driven a team and worked on a pile driver at fifteen to eighteen dollars a week and is now earning thirty dollars as a machinist. (3) The occupation should be one in which there will be a demand for workers after the war. This of course is self evident but further than this the man should be educated along the lines for which there is demand in his special community.

The man whose home is in the country would be educated along agricultural lines and the man from the large cities in manufacturing, salesmanship, stenography, etc. This need is not compelling but in general an occupation should be selected which would not necessarily mean a change of residence. (4) In certain instances the man's special technical vocational training must be preceded by some general education in such fundamental studies as reading, writing and arithmetic which will enable him to qualify for some position not necessitating manual labor for which he may have been wholly incapacitated. A soldier writes: "When I came back from the front in October 1916 I was not able to read or write. Before the war I was driving a team at fifteen dollars a week. He took a course in the machine shop at McGill and says: 'If it had not been for the school I never would have been in the place where I am today and I expect to get about thirty dollars a week.'"

The selection of a new occupation will rest with the vocational director after consulting with the surgeon as to the man's special disability. The director talks with the man, makes a survey of his education and previous trade, his mentality and his tastes, tells him of the successes of other re-educated men and encourages him to ambition and hopefulness. At Port Villez in Belgium for instance after this the man is allowed to visit the workshops where there are forty-eight trades. He walks about them, talks to the men employed and is given two or three days to consider the matter. He then comes before a board consisting of the surgeon, the technical director and the vocational director and with their

assistance chooses a trade provisionally in which he goes to work. If this proves unsuitable he may change but changing and uncertainty are discouraged. There are two practical obstacles found on the part of the soldier to vocational training. First laziness and second the fear that if he is physically improved his pension will be cut down. This latter matter has been dealt with by provisions that the man's pension is estimated on his original injury and is not affected by his improvement. This is regarded in Canada as so important that in convalescent homes and hospitals there is posted a statement that pension depends solely upon degree of disability and are not influenced by increased earning power.

The trades which are taught need not be mentioned individually. They may be divided roughly into three groups:

- 1 Industrial Trades machine work black smithing metal work carpentry tailoring brush making shoemaking leather work box making toy making bookbinding manufacture and repair of artificial limbs etc.
- 2 Commercial Clerical occupations Stenography telegraphy designing bookkeeping mechanical drafting etc.
- 3 Agricultural pursuits.

**Placement.** Finally comes the terminal stage of vocational training that of placing the man in a permanent position. Here again the public and through it the manufacturer must be educated to prying the country's debt to these men by employing them. There is to be met the natural reluctance of the manufacturer to employ a man for whom he fears he may have to make allowances and the possible opposition of labor with regard to these. The statement is made in *American Industries* for October 1917. There is an almost universal willingness on the part of manufacturers to give every opportunity to our workers who may be injured or crippled in the war. F. W. Keogh editor of *American Industries* the organ of the National Association of Manufacturers in a recent speech quoted the president of that association as saying: "I am first an American and a patriot and as such I will aid these men in every way possible. I am also a manufacturer with

economical responsibilities to my stockholders, employees and others and as such I cannot consider the men as employees unless I am convinced it is a sound business proposition. Fortunately evidence so far collected proves that the disabled soldier can return to industry as a sound business proposition for the manufacturers and for this reason it is essential that his training should be thorough so that in the years following the war he may be able to hold his own."

The attitude of labor toward these men is also a great factor. The general attitude of the British labor party as to treatment of disability by war is that every possible opportunity should be offered for securing the best treatment and that every appliance that science can suggest should be devoted to the restoration and aid of those who have become disabled and the labor party favors the opening up of every possible avenue of training to every man who desires to avail himself of it. The British trades union are not only sympathetic but desire to assist the disabled man in every possible way to secure employment on remunerative work provided that there should be no diminution in the standard of living or possibility of the disabled man being used to defeat the legitimate objects which the trade unions have in view. The man's first placement is of importance because no subsequent one will be so easily brought about.

The requirements for success in the whole of vocational re-education are judicious selection of the new trade, the utmost thoroughness in training care and discretion in placement.

**Training of teachers.** The training of teachers for bedside occupation curative workshop and vocational training and especially training men for the responsible post of vocational directors is another of the problems confronting us. The Federal Board for Vocational Education estimates that four teachers will be needed for every hundred disabled soldiers and regards this as an undeniably low figure. On this basis for every million men overseas there will be required here 100 such teachers. The provisions for

educating these teachers are being considered by the Federal Board for Vocational Training, as presented in a special Bulletin No 5

*Industrial accidents* There will be a by-product of the war and its experiences which has been mentioned and this is the fact that rehabilitation of those disabled in the industries will in the future be practised in the light of what we shall have learned from the rehabilitation of those disabled in war. In 1915, there were 1,000,000 industrial accidents in the United States involving more than a four weeks disability. In Scandinavia, Belgium and France there existed before the war trade schools for the re-education of those crippled by industrial accidents. There were also schools in Petrograd and Munich but in this country the matter has never received serious consideration. Professor Amar may be quoted as saying: "The war will be over but the industrial work and the necessity for the scientific study and physical organization of it will be with us forever." A report of the Federal Board for Vocational Re-education summarizes the matter of our negligence as follows: "It is certain however that our economic future depends to a large extent upon the rehabilitation of those disabled both in war and industry. The time has passed when the supply of skilled labor is as inexhaustible as our natural resources were thought to be. We can no longer afford to continue our former wasteful methods and we must conserve every vestige of labor as an economic asset." (Bulletin No 6.) The problem of the industrial cripple cannot be lightly dismissed for its size and economic importance are very great. From a study of industrial accidents in sixteen states figures made available by the publication of state bureaus checked up by the standard accident table and Bulletin 103 of the Department of Labor, Rubinow drew the following conclusions: Of the 6,136,676 employees in the different states covered or not covered by the compensation law, there are about 1,900,000 non-fatal accidents per year. Estimating the number of permanent disabilities produced annually by industrial accidents in the United States, Rubinow arrived at a mean estimate

of about 83,000 per year. In 1916 there were injured on the steam railroads 196,722 counting 10,000 deaths and on the electric roads 4,606. That is practically 200,000 people. Naturally many of these accidents were unimportant and not disabling but in 200,000 injured on steam or electric cars there would obviously be a fair proportion of disabled persons. In April 1916 the Philadelphia branch of the Pennsylvania State Bureau of Employment established a department for the placement of handicapped workers and visited fifty-five of the leading industrial firms in Philadelphia and made progress toward overcoming the innate prejudice against the employment of cripples. Many instances are given of workers thus placed who are earning surprisingly good wages.

#### SUMMARY

The difficulty of presenting this question of reconstruction must be evident. It is a new subject only in its formative stage as yet practically dating from 1915. There are many disputed points and many matters of policy yet unsettled and no mechanism has existed in the past for formulating and carrying on the demands which must be met.

In this matter we are not discussing a new form of charity but are trying to formulate a plan to discharge a pressing obligation. Success depends upon sound public sentiment and sentimentality and emotionalism have no place in the scheme. The government, the public, the manufacturer, the labor unions and the medical profession must join hands and different points of view must be minimized for the common welfare. This is no small question which we face; it would be better for most of the seriously wounded men to die on the battlefield than for us to fail in our duty of efficiently caring for them and restoring them to the highest possible degree of economic efficiency. Let us hold up the hands of the Government in carrying out the carefully formulated and studied plans which will be announced in due time and let us remember that destructive criticism is easy and constructive organization difficult.

# COMBINED INGUINO-FEMORAL HERNIA DUE TO SUPPURATIVE DESTRUCTION OF POUPART'S LIGAMENT WITH USE OF THE SARTORIUS MUSCLE IN REPAIR

By E. D. TWYMAN, M.D., LA. City, MISSOURI

COMBINED inguino-femoral hernia is an unusual type depending for its peculiar morphology on a defect or lesion of continuity of Poupart's ligament. Therefore the visceral protrusion whether originally inguinal or femoral comes to occupy the aperture of exit of both types. In my case Poupart's ligament was destroyed by suppuration. Observations of Holmes (1885) and other older writers on suppuration in the groin and on the hernias that recur after operation tend to show that such an occurrence is more common than would appear from the meager notes available in the literature.

Combined inguino-femoral hernia should be distinguished from coincidental inguinal and femoral hernia. The latter is one of the phases of multiple hernia (illustrated by Fig. 1) and is not uncommon. Some interesting estimates of frequency as observed by various authors will be referred to later.

It is also the purpose of this paper to distinguish combined inguino-femoral hernia properly so called from the inguino-crural hernia of Holthouse with which it seems to have been confused in the elaborate classification of hernia by Ferguson. That they are not identical is shown by the descriptions and tables in Ferguson's work and by the original monograph of Holthouse. Dorland's Medical Dictionary has repeated the error or confusion of Ferguson's table.

The observations of Holthouse were keen and considering the time—1870—creditable. I am forced to omit his table which however shows conclusively that the inguino-crural hernia he had in mind was not a combined inguinal and crural hernia but merely an ordinary inguinal hernia that had turned outward into the groin.

He gives the following description and case records the second of which I have abbreviated.

As the book is no longer available except at the Surgeon General's office I give the full original description.

Be the above two forms of congenital hernia the first a third which differs from them mainly in the direction in which the protrusion takes exit into the bend of the thigh instead of downward into the crural space and which I shall not attempt to name the inguino-crural. Like the other two it is a congenital defect in the acquisition of the abdominal wall (although I believe this to be true as a general rule) the exception being as in a remarkable case related by Mr. Hulke where the sac acquired for its exit a cupped bottom in the groin and scrotum. It remains in the belly but exists as a congenital defect—the agnate process of peritonum in the middle of the canal of Nuck as it is termed in the female—remains patent after birth with the result as a really formed receptacle for a protrusion. If the testicle shall not have descended or only partially done so the scrotum on that side gradually eloped and a hernia forming through the external ring and having no external ority to receive it takes the direct route in which it meets with the least resistance. I repeat and thus Mr. Aston Key in recording a case of this kind observes: "The hernia instead of passing downward into the scrotum turned after emerging from the inguinal canal over the tendon of the external oblique muscle and appeared some distance above the femoral hernia. The testicle had never descended lower than the external ring and explained the peculiarity in the course of the hernia. But this explanation will not apply while the patient is a female. I must seek therefore for some additional reason for the hernia taking an unusual course than an imperfectly descended scrotum. I think it is probably in the large size of the external abdominal ring and the lax condition of its pillars as illustrated in the following case:

Case 3. Congenital inguino-crural hernia with testicle in the same sac. The patient is a young man admitted to the Westminster Hospital in the morning of the 14th of May 1881. The hernia is the size of a fist and has been present since birth. It is a large hernia and has been present since birth. It is a large hernia and has been present since birth. It is a large hernia and has been present since birth.

My observations of this case were made in the following manner: I examined the patient in the morning of the 14th of May 1881. The hernia was found to be a large hernia and was present since birth. It was found to be a large hernia and was present since birth. It was found to be a large hernia and was present since birth.

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a heavy flagstone into his case it had become much larger and also painful. At 9 p.m. the house surgeon being in doubt as to the nature and condition of the hernia asked me to see it. I found a large oblong prominent tumor the size of a goose egg lying parallel with and above Poupart's ligament. It was movable, highly elastic and resonant on a filip with the finger the skin over it was neither tense nor hot. There was no testicle in the scrotum which could scarcely be said to be lost on that side but this gland could be felt and formed the upper part of the swelling. On introducing the finger through the external abdominal ring the outer margin of that opening was occluded by a fold of bowel which has passed through and out of the ring and finding no scrotum into which to descend has passed outward and upward and lay immediately between the integuments and the aponeurosis of the external oblique constituting the tumor above mentioned. On pressing this down and a portion the size of a large marble could be made to protrude into the upper part of the undescended scrotum. As handling was painful and there was no sign of strangulation the taxis was not employed but ice as directed to be applied to the tumor and a grain of opium in form of pill were ordered to be given every three hours if necessary. On the following day the tumor had disappeared and nothing but fullness occupied its former site this was found to be owing to the testis which occupied a large adventitious pouch between the skin and the muscular aponeurosis and could be pushed about from one part to another with the greatest freedom and without pain. The ring on the opposite side as small and its enlargement would only just admit the point of the finger which gave pain.

It will be noticed in reading the above case that notwithstanding the bulk of the protruded intestine the finger could be readily introduced into the inguinal canal proving therefore the large size of the ring and the lax condition of its pillars. This was further verified after the reduction of the bowel and was in striking contrast with the condition of the opposite ring. Dr Munro in his *Morbid Anatomy of the Human Gullet* p. 467 has recorded such a case in the female. The hernial sac he tells us was about two inches in length and in shape resembled a Florence flask, the bulbous extremity extending from the lower orifice of the canal was contained in the upper part of the thigh lying more in the course of a crural than an inguinal hernia. By dissection we ascertained that the deviation from the usual direction of the tumor was produced by a premature separation from each other of the external pillars of the inguinal canal.

The following is a very interesting example of this rare form of hernia which occurred in a young female.

CASE 4. Irreducible congenital inguocrural epiplocele resembling an ovarian hernia. Miss — age 18 while swimming had sudden pain and a sensation in the right groin as if something had given away. It always behaved (after the initial attack) like an inflammatory swelling. I saw her and found a small tumor in the right groin of an oblong form and about the size of an unshelled almond. It was so tender to the touch and was not more evident when the patient stood than when she was lying down. There was no appreciable impulse on coughing and it could not be reduced. It had

never disappeared since its initial appearance three years before though its size had varied slightly and also the degree of tenderness. I diagnosed a small irreducible epiplocele but some weeks subsequently on learning from Dr B that it became larger and more tender on the accession of her monthly periods I altered my opinion and looked upon it as an ovarian rupture. It was incised in a capsule which I detached from the surrounding connective tissue quite up to the external abdominal ring immediately outside of which it lay. It was opened and the supposed ovary at once displayed and nothing else. The wound healed by first intention. On a subsequent examination — the tumor turned out to be only a portion of omentum but presenting exactly the appearance of an ovary.

Holthouse continues his remarks on page 18. The chief interest attached to the inguocrural hernia lies in its resemblance to femoral rupture for which it may be readily mistaken. There are many cases within my knowledge observes Dr Munro where this mistake was never discovered until after the operation had been performed. Its diagnosis in the male can be readily established by a digital exploration of the inguinal canal and by the absence of the testicle from the scrotum. In the female by the normal condition of the femoral ring and the fullness in the course of the inguinal canal and in both by the sudden occurrence of the rupture.

In the treatment of these congenital varieties of hernia there is nothing special and what is proper to be done in the several conditions to which hernia is liable will be pointed out in the chapter devoted to this part of my subject.

To present the reader with a bird's eye view of the varieties of hernia spoken of in the preceding pages I have arranged them as below.

- I Ordinary (sac formed gradually)
  - a Incomplete or bubonocoele
  - b Hernia in the inguinal canal
  - c Complete or scrotal (hernia above the testis)

- II Congenital (sac ready formed)
  - a Inguinoscrotal (hernia above the testis. Hernia in front of and in contact with the testis)
  - b Inguocrural (Hernia in bend of thigh between the skin and aponeurosis of the external oblique muscle)

It is readily seen from the above cited descriptions and case reports that Holthouse's hernia is not a combined inguocrural or inguofemoral hernia but is only an inguocrural hernia in the sense that the sac takes that direction after emergence from the ex-

ternal abdominal ring in the usual manner. As it comes to lie under the skin of Scarpa's triangle it might better be known as inguino-scarpal to distinguish it from the more usual inguinoscrotal type. It is evident from the remarks of Holthouse quoting Munro and Key and Hulke that true Holthouse hernia is not a great rarity and the possibility of its occurrence should constantly be kept in mind in the differential diagnosis of femoral hernia. I have recored a case of my own in which I made a diagnosis of incarcerated femoral epiplocele and at operation found that the sac had emerged from the external ring and passed downward over Poupart's ligament into the groin. In another case there were sacs in both femoral and inguinal ring and in a number of cases the typical reflection of a sac of femoral origin upward over Poupart's ligament was observed. As the content of the sacs could not be reduced and were under considerable tension the positive diagnosis was not readily made in all cases. As the patients were all women the inclination was to regard all these hernias as probably of femoral origin. There is no penalty for such a mistake in this day of open operations as the truth is readily apparent when the sacs are dissected out. But at the time of Holthouse first paper *Practical Observation on the Radical Cure of Inguinal Hernia* 1838 when the operation of Riffs and of Wood were the operations of choice or even at the time of the second publication it might have invalidated the procedure proposed for relief.

Ferguson appears to be the next to attempt an authoritative classification of hernia. He says

In attempting to make a classification of abdominal hernias one is confronted at the outset by the fact that up to the present no one has made a classification on which is of any marked service to the clinician or to the student. There are so many varieties of hernia and combinations of different kinds that it seems almost hopeless to undertake to make any sort of classification that will be of use to anyone.

It is customary to refer to hernias as being congenital or acquired. That is a classification based on etiology. It cannot be subdivided. These hernias are divided into inguinal femoral ventral diaphragmatic etc making it incumbent on the

physician to memorize the various forms of the affection without any systematic attempt at classification.

In presenting the following arrangement the author has divided hernias of the abdomen and its wall with reference to their topography into (1) anterior (2) posterior (3) superior (4) inferior (5) lateral and (6) internal. This classification although new possesses the recommendation of being exceedingly simple and a rational logical. It is an anatomic classification. To the best knowledge of the author no other concrete and simple classification of abdominal hernias has been made and the one here offered may be somewhat crude and open to improvements. However it will serve as a guide in future efforts at classification of these hernias.

His table covers three pages with great detail. Under Anterior Herniæ he gives (a) inguinal with ten subdivisions (in common with other writers he has mixed hernias of different exits with those distinguished by the final position of the sac) (b) femoral with seven subdivisions (c) inguinocrural (Holthouse combined inguinal and femoral) (d) interior retroperitoneal (Treves) (e) epigastric (f) ventral (congenital or acquired) (g) urachil (h) umbilical with five subdivisions.

It is readily seen that Ferguson has placed combined inguinocrural hernia properly in his outline but has improperly credited it to Holthouse. Also that Holthouse's hernia inguinocrural or more properly inguino-scarpal hernia should be added to Ferguson's outline under the subheading of oblique inguinal hernia as a subvariety. This would serve to distinguish it from inguinoscrotal hernia which is the alternative course of the

There seems to be no doubt that Ferguson had seen or at least had heard of cases of combined inguinofemoral hernia and that it was a purely literary error that led him to call it Holthouse's hernia. I have been at some pains to discover some other description or direct reference to this condition but thus far have been unable to find one. Even Ferguson does not describe it farther than has been indicated. My case seems to be the first reported with a description. (Section on hernia and its forms and classification were inspected in the Surgeon General's Library Index *Journal of the American*

Medical Association SURGERY GYNECOLOGY AND OBSTETRICS and *Annals of Surgery* Woods *Monograph on Hernia* E V von Bergman *System of Practical Surgery* E W Andrews in *American Practice of Surgery* Bryant and Buck *American Textbook of Surgery* Coley and Bull Two Thousand Operations for Hernia *Journal of the American Medical Association* 1907 Moynihan *Rarer Forms of Hernia* *British Medical Journal* February 4 1900 S Weil *Rare Forms of Hernia and Unusual Contents* *Zeitschrift fuer aerthliche Fortbildung* 1913 x 417)

In regard to the etiology there seems to be no record of a congenital absence or defect of Poupart's ligament

However any injury producing a lesion of continuity of Poupart's ligament would give the way for a combined inguino-femoral hernia Bayonet sword or bullet wounds may sever it Or it may be cut in the course of a surgical operation Dr Howard Hill advises free section of the ligament in cases of strangulated femoral hernia when the neck of the sac cannot readily be freed in the ordinary way Ferguson mentions and advises its immediate division in case an aberrant obturator artery is wounded in operating on a femoral hernia and the operation of J Iabriqueus for femoral hernia calls for severance of the ligamentous attachment to the pubic bone And though it be immediately repaired one can conceive of failure of union or loss of the new attachment by infection in which case a combined inguino-femoral hernia would be the result

The operation of Roux also used by J C Renton<sup>1</sup> may cause the severance of Poupart's ligament by excessive strangulation under the staple driven into the pubic bone The same is true of operations in which the ligament is surrounded with wire silk or even cutgut ligatures which are drawn too tightly Even in the inguinal hernia repairs the tightly drawn sutures around Poupart's ligament may cut through though doubtless it is the conjoined tendon that most frequently suffers in these cases It is probable that it is in view of this danger that E W Andrews

in his imbricating operation ties the deep mattress sutures outside all fascial layers in such a way that they never strangle the ligament as it does not truly surround the ligament at any one point All authors advise avoidance of undue tension and although I have not found a record of the ultimate disaster of the loss of the ligament one might venture the opinion that if the scar tissue in old recurrent hernias after suppuration and failure of union were more readily separable so that the true anatomy might be seen this incident would be found to be of relatively frequent occurrence An abbreviated quotation from Holmes *System of Surgery* p 75 reads Crural hernia rarely reaches the size of inguinal hernia But occasionally after an operation for the liberation of a strangulated bowel when the tissues around the crural aperture have been weakened by cutting them and the sufferer has neglected to employ the support afforded by a truss nearly the whole of the alimentary canal may protrude He then quotes a case of the kind described where the tumor of a cylindrical shape reached to the middle of the thigh

It does not seem to be stretching the argument to assume that this writer was really describing the occurrence of a hernia in which Poupart's ligament was either cut by the blunted bistoury which was the prescribed method of relief of the strangulating band in that day or so weakened that it gave way later At any rate that it must have been lost since as he states in his premise Crural hernia seldom reaches the size of inguinal for the very good reason that it cannot do so as long as Poupart's ligament is intact

Even allowing for the entire loss of Gimbernat's ligament or the disruption of the tissues to the outer side of the crural ring so that the hernial protrusion entirely overles the femoral vessels as is the case in Velpeau's hernia does not give space enough for such an enormous protrusion

Loss of Poupart's ligament might occur as a secondary result of prolonged suppuration in a number of conditions

Glandular suppurations abscesses of the wall of the abdomen psoas abscesses stangu



lated omentum or strangulated bowel with pus formation and opening to the surface appendicitis in the hernial sac or appendicitis with the appendix lying on the back of a hernial sac with abscess formation or lastly appendiceal abscess forming in the usual location but traveling downward under Poupart's ligament may be considered as conditions predisposing to this accident.

Howard Kelly mentions abscesses opening into the bowel into the bladder into the pleura into the gluteal region with involvement of the trochanteric and gluteal muscles with pus and then says "Lastly in abscess may point under the crural arch and even as low as the popliteal space." Gross under "Affections of the Groin" records abscesses of the groin which develop in the late stages of typhlitis and perityphlitis which toward the last developed a green color probably due to staining from the intestinal contents. Hill calls this green groin.

Holmes *System of Surgery* p. 594 *16 dominal Abscesses* by George L. Collock revised by J. H. C. Simes M.D. reads: "When the external opening has been long delayed by nature or the surgeon we find in addition to the suppurative cavity in the iliac region that the abscess has passed under Poupart's ligament."

after a time other collections of matter point either in the groin or the thigh or about the ischiatic ramus. Notwithstanding

we occasionally find a patient recover as it were from a bed of death and after he has endured the opening of a great number of consecutive abscesses the sinuses slowly contract the discharge diminishes by degrees and ultimately ceases. The patient however recovers with a crippled limb as a general rule. The suppurative action usually implicates the psoas and iliacus so much and often the adductor muscles that the movements of the thigh are subsequently restricted nor can the limb be extended to its normal limit. It is such a suppuration as this forunately no longer seen that destroyed the ligament in my case.

The appendix may lie in the sac of a hernia according to Kelly in 1 or 2 per cent of cases or in the wall of the sac as first reported by

Finney (quoted from Kelly). Every operator has seen both occurrences and appendicitis in the sac is not uncommon both with or without abscess formation. The diagnosis can occasionally be made before operation. However coincident appendicitis in hernia has been diagnosed *strangulated hernia*. As either appendicitis in hernia or strangulation of the appendix in hernia may cause the other condition it is sometimes a fine point to decide even after operation. In either case the suppuration if long neglected may lead to ligamentous destruction. Nor must one forget that the same sequence of events may occur in the hernial rings of the left side of the body either in cases of *situs transversus* general splanchnoptosis with elongated caecum and appendix deformities of the spine or as seen in the case of autopsy No. 2136 Johns Hopkins Hospital 1913 a large iliac hernia on the left may draw the appendix and caecum over.

As there is no record other than the patient's report of the aching of his physician at the time of the original illness one is not able to decide just what the sequence of events was in the following case. The foregoing considerations were set down as bearing on the general possibilities of such formations.

The case was observed in 1913 and may be described as follows:

Fred K. farmer age 44 weight 220 pounds married had enjoyed good health and had not noticed the presence of any signs of intestinal trouble. At the age of 44 he had experienced a severe illness diagnosed by his physicians as appendicitis at that time a little recognized disease. An enlargement which proved to be an abscess formed in his lower right abdominal region and in 6 or 8 weeks it pointed in two places i.e. the right inguinal region and right Scarpas triangle. These were incised and the two resulting fistulae discharged foul pus for five months. Later he noticed a bulge in this region which proved to be a definite hernia. The tumor increased in size despite the employment of a truss and trusses prescribed for the purpose of giving support and retaining the viscera. It became progressively more difficult to control and there were several attacks of partial strangulation or torsion. These always yielded to rest and taxis but in 1913 he has a specially severe attack follow-

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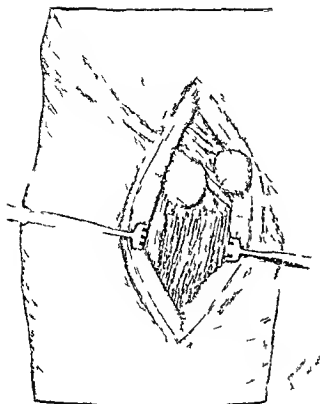


Fig 1 Multiple hernia

ing a fall in which there was direct trauma to the hernia and its contents. By this time there was always a quantity of viscera in the sac and he wore a sort of quilted abdominal supporter with leg straps for protection. During all this time the patient was gradually increasing in weight which added to the discomfort of the hernia and the difficulty of its retention. He had had no further appendiceal symptoms.

**Physical Examination** A fat but otherwise healthy appearing male. In the right groin appeared a bulging tumefaction larger than a fetal head at term, occupying all the space of an inguinal hernia plus the femoral or space of Scarpa's triangle. The edges of the defect subtended the entire amount of space of the protrusion.

Two scars were present with some cheloid formation of skin, one above and one below the usual site of Poupart's ligament. The usual groove marking the site of this structure was absent. In spite of this the true condition of combined inguino-femoral hernia was not suspected as I was not familiar with it.

The right scrotal region also was distended. There were both tympanic and dull areas over the sac on percussion. On lying down a part of the contents could be returned to the abdomen but not all. A diagnosis was made of right inguinal hernia partially incarcerated with loss of tissue from the previous suppuration.

He was given a guarded prognosis regarding the

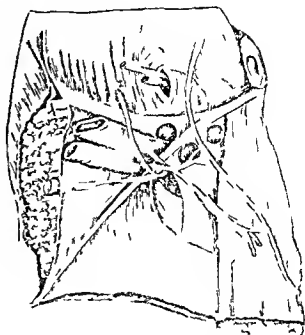


Fig 2 Normal anatomy (modified after Gray and Ferguson)

probability of a cure and warned of the possibility that a right castration or a transplantation of the testicle would be required to make a permanent result more likely. He definitely rejected the right castration but consented to the transplantation should it be necessary.

He was placed in a recumbent posture for four days and the bowels thoroughly emptied. The tissues were relieved of the pressure and rested. Under ether the fistulous skin scars were removed and the neck area and contents of the sac defined. It was found that Poupart's ligament has sloughed away from over the crural vessels and that the hernial sac occupied the usual space of both inguinal and crural hernias lying directly upon the femoral vessels. A plausible explanation for the two fistulae was then apparent. It appeared that the abscess must have pointed through both inguinal and femoral canals and all the intervening tissue sloughed away. There was fusion from the inflammatory process of the muscular and fascial tissues of the superior edges of the gap in the abdominal wall. This gap or defect extended upward for four or five inches and was bounded externally by the anterior superior spine of the ileum and internally by the outer border of the rectus plus a fringe of scar tissue and the remains of the oblique and transversalis muscles. Below the sac lay on the femoral vessels and the tissues of the floor of Scarpa's triangle. Recognizable vestiges of Poupart's ligament remained at either end entangled in scar tissue but the crural arch had disappeared and the falciform ligament was gone. Scar tissue overlay the vessels in the region of the saphenous opening and upward.

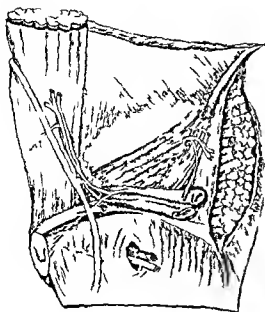


Fig. 2. Diagrammatic illustration of the hernia and its position in the inguinal region.

The content of the hernia, i.e., the small intestine and the large intestine, had slipped into the gap so that a part of the rectum protruded through the hernia.

All of these were related to the hernia. The small intestine was found to be in the position of the preperitoneal prepapula, having reduced the size and made the reduction easier. The cord was lifted and the peritoneum attached to the femoral foramen of the inguinal ring. The annular ring of the inguinal ring was the edge of the peritoneum covering the cord. It was united to the peritoneal side of the flap as far as the inner side of the hernia. A suture was then made in the remnant of the sac as laid down in the posterior rectus sheath side of the inguinal ring and attached by sutures to the outer side of the sac as possible. In this case the remaining sac was extended together with the inguinal cord tissues to permit a second reflection of the sac into itself in front of the defect, forming a pocket the principle of the McVay operation for the hernia.

The cord and testicle were disposed of in the following manner. The testicle was lifted from the scrotum and the scrotal sac obliterated by sutures. The testicle was then transplanted into a pocket in the preperitoneal fat below the pelvic brim. The cord, as stated before, lay in front and to the outer side of the sac. An attempt has been made in the modified diagrammatic illustration to show what I conceive the anatomy to have been. See Figures 3 and 4. The position of the deep epigastric vessel

to the inner and lower side of the protrusion I feel sure is correctly portrayed and the cord to the outer. Figure 2 modified after Gray and Ferguson shows the normal anatomy of the region.

I realize the possibility that there was first a direct protrusion through Hesselbach's triangle and that after having attained a certain size the further giving way of the damaged tissues may have so increased the area of the protrusion as to allow the greater bulge on the outer side of the deep epigastric vessels which then slipped or were crowded more and more to the inner side finally assuming the position in which they were found. The cord crossed the sac into the scrotum. Another possibility is that both inguinal and crural sacs pre-existed and that they were crowded into one as the sac grew larger. The femoral vessels were overlaid in toto.

No attempt was made to separate the tissue of the inner edge of the inguinal ring into their anatomical elements. By using the preurethral thickened strong edge a large amount of the tissue in the inguinal ring was removed as a direct suture with kangaroo tendon and chromic gut thread. The inguinal ring was then closed with the Cooper's ligament peritoneum from the iliopectineal line to the umbilicus of the inguinal ring and the beginning of the fascial ring or remnant of fascia. The inguinal ring was then closed with a desorbable although the length of the tissue looked promising for the result. However, the uterus and the ovary had the femoral vessels embedded into the leg, an appearance and extension of vessels in the inguinal point of the uterus. A suture for reinforcement as made a slip of the fascial ring with an attached peritoneal base attached and reflected over the inguinal ring in place. This effectively covered the above mentioned gap but as the fascial ring at that point in the thigh was thick and strong so in the outer part of the leg it was still unyielding to the tension of the inguinal ring. The tension of so large a gap was so great a subject. The scrotum was readily made available through the large opening in the skin without further enlargement. It was split into two equal portions and then attached to the middle of the thigh and the larger inner portion was divided squarely across its lower end and sutured in a d and attached to the fascia over the insertion of the right rectus muscle. Of course, although an effort has been made for the shrinkage of the muscle after the division. This placed a portion of the sartorius about the diameter of a half dollar squarely along and over the suture line as designed to strengthen it. It was cured at intervals by No. 1 chromic gut. It can still be felt in place.

and it has apparently preserved or acquired a nerve supply as it seems to contract when the leg is raised. The closure was completed by uniting the superficial fascia and the skin. A rubber wick was left to drain off broken down fat and serum. This discharged copiously for four or five days although fortunately there was no suppuration. The leg was kept in a flexed position for two weeks and a binder applied. The healing was afebrile till the seventh day when a rise of temperature coincident with pain and some swelling and tenderness along the course of the left saphenous vein proved this to be the site of the trouble but as oedema never developed we assumed that the deeper vessels were not involved at any rate not to the point of complete obstruction. The patient was kept in bed for a month and a binder similar to the one he wore before the operation was applied with the advice that its use be continued for six months. A graduated series of exercises designed to strengthen the parts was also advised and practiced. Heavy lifting straining at stool etc was forbidden. When I last saw the patient in 1915 two years after the operation there was no recurrence.

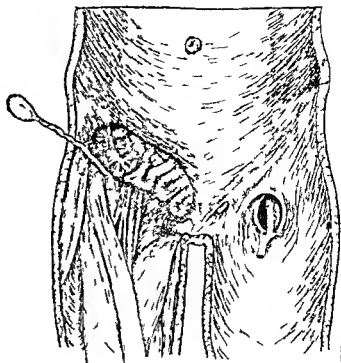


Fig. 4 Same as Figure 3

Multiple hernias are in the majority according to Gelpi<sup>1</sup> who cites an anatomical study showing at least a short (5 cm) sac on the weak side in 80 per cent of all cases of inguinal hernia. According to the theory of Koch-Waldy and Vonbergman this is due to the fact that if anatomical predisposition to one hernia exists it can just as readily produce a number. In conformity with this view Kaufman and Bernstein found in 279 dissections of unselected bodies that some hernia was present in 25.8 per cent of which 64 per cent were single and 19.4 per cent were multiple. Further observations of interest were that men were ruptured two and three quarters times as often as women but that whereas in men the relation of multiple to single was two and one-half to one in women it was nine and one-half to one. As for the number in one person Ferguson seems to hold the palm with a report of ten in one and the same individual.

It is not at all probable that 25 per cent of all people are clinically ruptured but only in an anatomical or predisposing sense i.e. the presence of a sac. The foregoing quotations of frequency bear on the possibility that my case had a pre-existing inguinal or crural sac

or possibly both even though it had never been noticed previous to the suppurative attack.

Berger reports 22 coincident inguinal and femoral hernias on one side 87 times on both sides 203 men and 19 women. In 105 cases there was an inguinal hernia on the other side also. Sometimes the inguinal hernia appears as a separate tumor although they often appear as one mass somewhat separated by Poupart's ligament. In these cases there is really extreme relaxation of the abdominal wall rather than a true hernia. Strangulation rarely occurs.

Muscle and tendon transplants have very often been successfully employed for the purpose of replacing missing tissues as the Fowler operation (for inguinal hernia with the use of the rectus muscle to replace the missing or defective conjoint tendon) for the restoration of functions lost by paralysis and for the mechanical plugging effect of so much tissue as in the Murphy transplantation of the pectoralis muscle to the axillary space after breast amputations and the Polya operation calling for the plugging of the femoral canal by the crowding into it of all

or a portion of the sartorius muscle. The sartorius was used by Mantelli to fill the inguinal canal in cases with weak tissues and the same procedure is mentioned by Ferguson. E. Wyllys Andrews mentions the use of the tensor fasciae femoris muscle for this purpose (no credit given) and also the reflection of the fascia lata from the upper part of the thigh to cover the repair line of an inguinal hernia. He calls all these unnecessary in view of the Andrew's imbrication method but in the above cited case the necessary tissues for the imbrication did not exist. Mantelli as has been indicated swings in the sartorius and lays it in the inguinal canal and fastens it by stitches to the abdominal side of the pubic arch using the entire muscle for the purpose. It may be that this is a better method than the one used in my case. He closes the tissues over the artorius in the usual Bassini way.

Since the successful free fascia transplants of Kirchner, Eidelberg, Vazner, Kernef, Neu, Hof and others it should now be considered a method of election for such cases.

The use of Cooper's ligament for a fixed point in the pubic region in repair work is one much disputed as to priority. It is variously credited to Seelig, Lohlske, Moschowitz, Lethissen and Dujarric.

E. Wyllys Andrews states that the cure of inguinal hernias by castration was such a common procedure in France in the middle centuries that it had to be interdicted by law on the grounds of public policy. This proceeding of course simplifies the problem of a stable union by doing away with the traversement of the line of union by the cord which in addition to the mere matter of a sufficient opening for its passage must not be constricted by undue pressure. If this should happen the testis might be lost by gangrene or atrophied from impaired circulation. Several such cases have resulted following the Halsted operation. Transplantation of the testis may accomplish the simplification of the closure; it seems to have been done by Lanphear in cases of the infantile type of hernia after first fashioning a tunica vaginalis for the testicle out of the

peritoneum of the sac. The testis he then placed in the abdomen and proceeded with the repair. Of course the testicle and cord could also have been brought out of a new opening in the abdominal wall at a point sufficiently distant from the repair wound not to weaken it. There would remain the danger of strangulation or of the formation of a new hernia at the point of emergence.

The cord transplantation of Fowler without disturbing the testis is altogether different.

The transplantation of the testis produces of course an artificial cryptorchidism. Some writers ascribe a malign influence of this position of the testicle in the matter of cancer formation. Coley and Bull in their report of two thousand cases of hernia in the course of which they encountered 114 cases of undescended testis make this remark. The danger of malignant disease developing as the result of undescended testis has we believe been exaggerated. No case of carcinoma or sarcoma of the undescended testis has been observed at the Hospital for the Ruptured and Crippled at least not during the last 20 years although it is but fair to state that one of us has seen sarcoma of the undescended testis in two cases observed outside the hospital.

It would seem that such a tendency if any exists could be accounted for either on the theory that there was a faulty embryological development or that the usual site of cryptorchids in the inguinal canal or external ring renders them more liable to trauma. If the latter were true and if the proposition could be supported that there is less likelihood of malignancy in a cryptorchid that has been operated upon and brought down (a very doubtful matter) then it should follow that the new position given this testicle in the abdomen should be just as safe or safer inasmuch as it is absolutely removed from the traumatic zone. If the first proposition is true one would have to argue a peculiar chemical fitness of the scrotum as a place for the testicle to reside, a fitness however that does not seem to prevent the occurrence of malignancy in normally placed testicles. On these grounds one is inclined to accept the theory of traumatism as the activating factor.

No very authoritative figures appear to be available on the proportion of malignancies occurring in undescended testicles. Hertzler on tumors does not mention the subject.

Much more radical means than this have been advocated for the relief of large hernias. Barker<sup>1</sup> advocates the resection of the colon. The writer has advocated a colostomy on the opposite side to take pressure off the diaphragm after returning a large hernia to the abdomen and has had opportunity to practice colostomy to take pressure off the stitches

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of an end to end sigmoidostomy. It was a very successful measure and appears to me less dangerous than the resection plan advocated by Barker.

This case is reported in the belief that it calls attention to an anatomical occurrence, i.e. the severance of Poupart's ligament that is not unique but has probably been overlooked in some cases and that it is worth while from a literary standpoint to distinguish properly the result — combined inguinofemoral hernia from the true inguinoscarnal hernia of Holthouse and from coincident inguinal and femoral hernia.

## ABERRANT THYROID TUMOR OF THE TONGUE

By MEYER A. RABINOWITZ M.D. BROOKLYN  
A t t S g d A t t N l g t t h J w h H p t l

IT is the intention of the author to call attention to an interesting and rare type of tongue tumor and to report a case that has come under his care.

**Frequency.** Storck (1) in 1904 collected 9 cases of lingual thyroid tumors from the literature and reported 3 cases of his own. Murphy (2) in 1905 brought the total number up to 39 cases which included personally observed cases. Charles Mayo (3) reported 3 cases and brought the known total up to 43. Since then the literature contains an occasional case so that the writer can estimate the total number of cases which have been observed up to this date to be in the neighborhood of 70.

**Age.** Lingual thyroid tumors occur most frequently between the ages of 15 and 45. This is most likely due to the fact that at this time of life the thyroid gland is at its highest point of physiological activity. The thyroid tissue of the tumor is capable of assisting in the thyroid function or it may take its place entirely if the thyroid gland in the neck be entirely absent or atrophied. The tumor may therefore make its appearance because of the need of additional thyroid secreting tissue. Ninety per cent of

all cases have occurred in females. This is in conformity with the fact that the thyroid gland is most commonly affected in women and at the period of greatest sexual activity of the organism.

**Embryology.** The thyroid gland develops from a median anlage which is derived from the pharyngeal epithelium and two lateral anlagen which are derived from the epithelium of the fourth branchial cleft. The



Fig. 1. Photograph of patient.

ness about the throat and some difficulty in speaking — her voice became muffled. She had frequent attacks of nose bleed in the first two weeks. There was neither cough nor dyspnea. A tumor of the tongue was discovered by a physician who made a diagnosis of carcinoma and sent her to the hospital for amputation of the tongue.

**Physical examination.** Physical examination (Fig 1) revealed a woman of short stature presenting many evidences of decreased thyroid secretion. There was a moderate atrophy of the scalp and the hair as dry lusterless straight and in color faded brown. Deep transverse wrinkles of the forehead were noticeable. The outer eyebrows were scanty. The eyelashes on the lower lid were practically absent. The eyes were widely separated. No epicanthic folds. Nose broadened. There were deep indentations of the lobule of the ears. The skin over the cheeks was thickened and of a dirty yellow color. In general the skin was markedly harsh and dry. There were no suprascapular pads. The tracheal rings were readily felt. There was no thyroid tissue in the normal site. The fingers were short and stubby without lunulae. The nails were broadened at the base and markedly brittle. The breasts were normal. No retrosternal thyroid palpable at the episternal notch nor made out by percussion of the area behind the sternum. The tenth rib on each side floated markedly. There was a very acute costosternal angle. There was marked gastroptosis with the greater curvature at the symphysis. The skin over the abdomen was markedly thickened and inelastic. The axillary and pubic hair was very scant. The lower extremities were small the nails showed degenerative change double hallux valgus present. The pupils and pupillary reflexes were normal. There were only two teeth present in the mouth. The hard palate in the median line at the middle third showed a hard elevated ridge evidently a hyperostosis. No gland of the neck palpable. The heart and lungs were normal. The knee jerks were hyperactive.

**Examination of the tongue.** Very little could be seen until the tongue was pulled out. A tumor one and one half inches in breadth as seen on the posterior part of the tongue extending to the foramen caecum and epiglottis. The mucous membrane was not ulcerated and was covered by large veins. Palpation with the finger of one hand on the tumor and the fingers of the other hand in the suprathyroid region demonstrated the fact that it occupied almost the entire thickness of the tongue extending well into the suprathyroid region. The tumor was neither hard nor tender. Because of

these characteristics of the tumor the absence of a normal thyroid in the neck and the evidences of hypothyroidism an absolute diagnosis of lingual thyroid tumor was made by the writer. A section of the tumor was removed for pathological examination. Marked bleeding occurred. This was controlled by many mattress sutures made in the tongue and tumor tissue. Because of the fact that this was evidently the only thyroid tissue the patient had and because there were no alarming symptoms of esophageal or laryngeal pressure it was decided not to do a total enucleation. Urine examinations were negative. Red blood cell 3,800,000. Hemoglobin 70 per cent. White blood cells differential — polymorphonuclears 55 per cent lymphocytes 33 per cent mononuclears 4 per cent eosinophiles 6 per cent basophiles 2 per cent. Blood pressure systolic 126 diastolic 84. Wassermann of the blood negative. Height 4½ feet weight 82½ pounds. Pulse before operation 64 to 80. Temperature before operation 98.6 F to 100 F. Examination of the removed tumor tissue by Dr S. Blattès, pathologist to the Jewish Hospital, revealed it to be thyroid tissue with marked adenomatous development. X-ray examination of the chest revealed no evidence of pulmonary or mediastinal new growth. An old healed tubercular process was revealed at the right hilum and apex.

**Treatment.** The patient was placed on thyroid feeding and felt much better and gained in weight. She was then lost sight of for one year. During this time she had stopped taking her thyroid tablets and had developed marked evidences of a psychosis. She claimed that she was troubled with enemies who pursued her and damaged her furniture and her garments. She was withal very quiet and related her experiences with a smile. She was placed on mixed glands including thyroid. One month later her family thought she was much better. On examination at this time December 1, 1917, her lingual tumor as only half its on also very hard and nodular. Her weight was 116 pounds. A marked atrophic nasopharyngitis was present. The pulse and temperature were normal.

Thwarted by Dr. Williams, the patient died of a port-growth metastatic disease.

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A STUDY OF THE KRUKENBERG TUMOR<sup>1</sup>

BY RALPH H MAJOR M D ROSEDALE KANSAS  
F m th P th l gical D partm t U rs ty f Kansa School f Med

IN 1896 Friedrich Krukenberg (1) described an ovarian tumor to which he gave the name *fibrosarcoma ovarii mucocellulare* (carcinomatodes). This tumor he considered essentially a fibrosarcoma but he also noted the presence in these neoplasms of certain cells which morphologically bore a close resemblance to carcinoma cells and for this reason he added the term *carcinomatodes*. Since Krukenberg's original description many additional cases have been described and this tumor now generally described as the Krukenberg tumor has been the occasion of considerable discussion.

A review of the literature reveals that this tumor has been considered by some a fibrosarcoma by others a carcinoma and also that there has been a difference of opinion as to whether it is really a primary ovarian growth. We have recently had an opportunity of studying a classic example of this tumor and for this reason it seemed advisable to present our findings in this case together with a resume of the cases reported up to this time.

In a review of the literature some difficulty has been found in deciding just which cases were true examples of this tumor. This growth was doubtless observed by some of the older pathologists before the work of Krukenberg. Waldeyer (2) in 1872 described an ovarian tumor which has been interpreted by some as a Krukenberg tumor. Similarly Leopold (3) in 1874 described two tumors which may belong to this group. Seeger (4) in 1888 reported two tumors which have been considered by some as examples of the Krukenberg tumor. An exhaustive study of the older literature on ovarian tumors would probably show many more belonging to this class. Since however we possess no definite criteria by which to judge these cases we have confined ourselves in the main to a study of the cases reported since Krukenberg drew attention to this tumor.

An additional difficulty has been found

due to differences in interpretation of these tumors. There are a number of cases of ovarian neoplasm reported which although they resembled the Krukenberg tumor have been put in other classes by their authors. This group of cases although some of them are probably examples of Krukenberg tumor have not been included but will be discussed separately. A somewhat different conception of the tumor was introduced by Sternberg (5) who describes a multiple endothelioma of the bone marrow as a Krukenberg tumor. However since this tumor was limited to the bone marrow and both ovaries were small and atrophic it would hardly seem to be an example of a Krukenberg tumor in the accepted sense in spite of its microscopic resemblance.

Krukenberg's original communication described the tumor with sufficient clearness to permit of its identification in most cases by subsequent investigators. The characteristics of the tumor he noted were that they are solid ovarian tumors usually bilateral appearing in youth as well as in old age and of slow growth. The entire ovary is increased in size maintains on the whole its outline but presents an uneven surface. Ascites is usually present. Microscopically the tumors show a well marked framework in the meshes of which are large swollen cells with a finely granular or mucoid protoplasm and the nucleus often is eccentrically placed. The thickening and extensive overgrowth of the ovarian connective tissue suggests a fibrosarcoma.

Krukenberg regarded the ovarian tumor as primary and it has been particularly about this point that much discussion has arisen. One group of observers describing it as a primary tumor while the other group consider it a secondary growth. It is of interest perhaps to follow the views of each group separately.

Krukenberg's paper describes five cases. Two of his cases were specimens sent to the



laboratory after operation and no further data is given. One case complained of stomach trouble and died after operation but no autopsy was obtained. Two of the patients came to autopsy, one showing a carcinoma of the stomach accompanying the ovarian tumor while in the protocol of the other autopsy no mention is made of the stomach which would probably indicate that it was considered normal. In none of his cases is there a record of a microscopical examination of the stomach.

Sternberg (6) described a case with a full autopsy report in which the primary tumor was apparently in the ovary with metastases to the lungs and dura mater. The stomach was normal both macroscopically and microscopically. An interesting feature of his case was the presence in the bone marrow of highly vascularized osteoid masses.

Schenk (7) in 1904 reported a case of primary Krukenberg tumor. His patient had bilateral ovarian tumors which were removed at operation. About five months after the primary operation the patient was readmitted with gastric symptoms and operated upon a second time. The patient died two months after the last operation. Autopsy showed a metastatic carcinoma of the peritoneal mesenteric lumbar iliac and inguinal lymph glands. The stomach, pancreas and intestines were apparently normal although no microscopic examination of these organs is mentioned.

Orthmann (8) described a primary ovarian sarcoma with extension to both tubes. The microscopic picture was that of a typical Krukenberg tumor. The patient died later but no autopsy findings are reported. Glockner (9) has reported a case of primary Krukenberg tumor in which the autopsy showed metastases to the spinal column but all the other organs were normal.

Rosthorn (10) reports a very interesting case in which there were bilateral ovarian tumors associated with multiple sarcomatosis of the skin, arcomatous involvement of the lymph glands, lungs, liver, pericardium, pleura and peritoneum. The stomach at operation was considered normal but no mention of it was made in the autopsy report.

Fischer (11) has reported two cases which he considered primary. Palpation of the stomach at operation in one case disclosed nothing abnormal and in the other case a gastric analysis showed no suspicion of cancer. Both cases left the clinic after operation and no subsequent notes are recorded. Fischer considers the tumor a sarcoma.

Krueger (12) in 1909 demonstrated bilateral Krukenberg tumors of the ovaries removed at operation from a patient nineteen years of age. He regarded the case as primary apparently because of the age of the patient.

Outerbridge (13) studied a case of bilateral ovarian Krukenberg tumors in which nothing abnormal was noted in the stomach at operation. The patient died later but no autopsy was performed. He thinks that in many cases reported as secondary the secondary nature is anything but satisfactorily demonstrated. Schwarz (14) reported a typical case of bilateral Krukenberg tumors. The patient died some time after operation and no autopsy was obtained. There were however no clinical symptoms of tumor in the gastro-intestinal tract. Foulrod (15) described a case in which a later operation revealed a carcinoma of the stomach. He believed his case to be a primary ovarian tumor because no stomach tumor was noted at the first operation.

A brief summary of this group of cases shows that all 16 cases of Krukenberg tumor were considered as probably primary. Since a decision on this point to be convincing must rest upon autopsy findings, it is interesting to note that of the 15 cases only 6 came to autopsy. Of these 6 cases one case (Krukenberg's) showed a carcinoma of the stomach, in 3 cases the stomach was described as normal and in 2 cases no mention of the stomach is made in the autopsy report which would suggest that the stomach was considered normal. In only 2 of this group of cases is there a record of a microscopic examination of the stomach (Sternberg and Glockner). Foulrod's case showed a carcinoma of the stomach at a later operation.

Of the 15 cases 3 were stated by their authors to be sarcomata. All of the other observers adopt Krukenberg's term, fibro-

sarcoma carcinomatodes and Glockner particularly emphasizes that this is a very accurate name for the condition. None of these observers apparently takes the view that it is a pure carcinoma.

As contrasted with this small group of cases in which the tumor was considered primary there is a much larger series in which the coexistence of a gastric or intestinal carcinoma was either definitely proved or was strongly suggested by the clinical findings in the case. In this series the ovarian tumor was regarded as secondary. Tiburtius (16) in 1899 described two cases of ovarian carcinoma secondary to carcinoma of the stomach. Although he does not refer to Krukenberg's work, his microscopic descriptions of the ovarian tumors describe quite accurately the typical picture of a Krukenberg tumor.

Kraus (17) reports a case occurring with a mucoid carcinoma of the cecum. Wagner (18) describes a typical case which he regarded as secondary to a scirrhous carcinoma ventriculi. Schlagenhauser (19) in an excellent paper on metastatic ovarian carcinomata records two cases in which a gastric carcinoma was present. His article emphasizes the frequency of ovarian metastases in carcinoma of the stomach and he points out also that such ovarian tumors are often diagnosed on removal as fibrosarcoma or sarcoma.

Stauder (20) reports 3 cases of Krukenberg tumor in one of which a gastric carcinoma was present at autopsy while in the other 2 it was suspected clinically. Glockner (21) in a report of 17 cases of metastatic ovarian carcinoma found 2 cases of Krukenberg tumor both with carcinoma of the stomach. He also believes ovarian metastases from the stomach to be much commoner than is generally supposed.

Amann (22) refers to 4 cases regarded as secondary. Stickel (23) describes a metastatic Krukenberg tumor secondary to a carcinoma of the stomach demonstrated at autopsy. Sındrock (24) reported a case in a patient with hematemesis and other symptoms of gastric carcinoma who subsequently died but did not come to autopsy. Burdinsky (25) has recorded an interesting case in which the Krukenberg tumor was complicated by

pregnancy. A cesarean section was performed and a living child delivered. The patient died later and the autopsy revealed a scirrhous cancer of the stomach.

Ulesko Stroganoff (25) has reported 3 cases. All of the cases left the hospital apparently cured and their subsequent history is unknown. Two of the cases had symptoms of stomach disease, vomiting, loss of appetite and diarrhoea. She believed her cases to be secondary to a colloid tumor probably in the stomach.

Cohn (7) has described 4 cases of Krukenberg tumor. One of these cases had a primary carcinoma of the stomach. 1 had a carcinoma of the sigmoid. 1 case showed enlarged retroperitoneal glands at operation but no definite cancer and the fourth case showed no cancer at autopsy. Cohn however in a discussion of these cases notes that of the 2 cases which had apparently no primary cancer of the gastro-intestinal tract, 1 case at operation strongly suggested such a complication and the other case was autopsied in 1898 and no microscopic study was made. The oedema of the colon noted at autopsy however strongly suggested a cancer of this organ.

Hussy (28) reports a case following resection of the stomach for a carcinoma. Kuhlhoff (29) describes a patient with a Krukenberg tumor who died two months after operation. No autopsy was obtained but as the patient often vomited blood and passed tarry stools it was regarded as a case of gastric carcinoma.

Jacobson (30) studied a patient who showed cancer of the stomach at operation. No autopsy was performed.

Mandl (31) reports a case in which a carcinoma of the pylorus was felt at operation. Hall (32) studied a case which came to autopsy and showed a carcinoma of the pylorus. Bondy (33) presented 4 cases which he considered as secondary. Stone (34) has described 3 cases, 1 secondary to a carcinoma of the stomach, 1 a probable metastasis and in 1 case no data was available. His article is an excellent study on the subject of metastatic ovarian carcinoma and contains a good review of the literature. Reel (35) describes the examination of a specimen removed at

operation which suggested a metastatic growth

A brief review of this series where the ovarian tumor was regarded as secondary shows that in all 38 cases have been described. Of this number 12 showed a primary tumor of the gastro intestinal tract at autopsy and in 5 cases a carcinoma of the stomach was seen at operation. Eight cases in which no autopsy was performed gave a history of gastric disease 2 of them vomiting blood. It would be hazardous to regard all of these 9 cases as having a cancer but the vomiting blood were almost surely suffering from malignant disease of the stomach. This gives a total of 17 of the 38 cases suffering from carcinoma of the stomach or intestines 2 cases most probable and 6 cases doubtful but probable — 5 in all. In 4 cases it was considered probable from operative findings and in 9 cases no data was given. In all it seems safe to assume that in at least 19 of the 38 or 50 per cent the diagnosis of a primary carcinoma elsewhere was established.

A third series of cases those of probable Krukenberg tumor is of interest also. Bode (36) described a case of endothelial sarcoma of the right ovary in a patient who was operated upon two years previously for a carcinoma of the pylorus. Rosinsky (37) observed two endotheliomata one of which was associated with a tumor of the stomach. He recognized the resemblance to the Krukenberg tumor but preferred the diagnosis of endothelioma. Fleischmann (38) reported a case of fibrosarcoma myxomatodes of both ovaries in a patient who showed at autopsy a carcinoma of the pylorus. Romer (39) described 2 cases of ovarian carcinoma secondary to carcinoma of the stomach. His description of the ovarian tumors suggests strongly the picture of a Krukenberg tumor. Polano (40) studied 5 cases of malignant ovarian tumors 2 of which were metastatic. One diagnosed as an endothelioma was secondary to a mucoid carcinoma of the breast and the second case diagnosed as a fibrosarcoma was a metastasis from a gastric carcinoma. Stickel (loc cit) describes 1 case of metastatic ovarian carcinoma which resembled in part the Krukenberg tumor.

If the cases of this group are really those of Krukenberg tumor an analysis shows that of the 17 cases all but one were definitely metastatic. It is also of interest that 3 of these cases although resembling closely the Krukenberg tumor were diagnosed as endothelioma. The diagnosis of endothelioma of the ovary has been very frequently made particularly by certain investigators. Krukenberg himself describes his tumor as resembling closely an endothelioma. The statement of Aschoff (41) however that most endotheliomata of the ovary should be considered as carcinomata represents a point of view that is constantly gaining ground.

The following case is presented as a contribution to the subject of the Krukenberg tumor. It is of considerable interest since in this patient those questions are fairly clear concerning the primary or secondary nature of the tumor, the origin of the striking tumor cells present and also as to its probable method of metastasis.

The patient A. C. a colored woman age 40 years, was admitted to the Bell Memorial Hospital complaining of headache, dimness of vision and pain in the stomach. Her present illness began about one year before admission with pain in the stomach and vomiting. At times she vomited blood and had tarry stools. Her condition has grown steadily worse and she has lost 80 pounds since the onset of her illness. The most important of the physical findings was the presence of a mass in the pelvis. The blood examination showed red blood corpuscles 4,000,000, white blood corpuscles 10,500, hemoglobin 40 per cent. She died suddenly on June 10, 1917 and the autopsy was performed eight hours after death.

The autopsy showed the body of a very emaciated woman 165 centimeters in length, very little subcutaneous fat present. On opening the abdomen there was about 500 cubic centimeters of clear straw colored fluid present. The heart, lungs, spleen, liver, pancreas and adrenal were apparently normal. The kidneys showed a finely granular surface on stripping the capsule. The pituitary gland was enlarged and weighed 950 milligrams. The organs of most interest were the ovaries and stomach.

Both ovaries (Fig. 1) were the seat of nodular tumor growths about equal in size and measuring 7 x 9 x 7 centimeters. The surface of each nodule is quite smooth and the individual nodules vary greatly in size, the largest measuring 4.5 centimeters. The smaller nodules are white and quite firm. Like the larger nodules have a reddish purple color and are much softer. The right ovary contains a cyst measuring 4 x 5 centimeters which has a

smooth wall and is filled with a clear yellowish fluid.

The stomach (Fig. 2) is somewhat shrunken in size, measures 14 x 7 centimeters and the anterior surface is covered with numerous very small wart-like elevations. The wall of the stomach is markedly thickened, measures on the average 2 centimeters in thickness and is quite firm and tough. The mucous membrane of the stomach is somewhat reddened but is everywhere quite smooth. There are no erosions of the stomach mucosa and no tumor anywhere growing out from it. There is an enlarged lymph gland at the hilus of the stomach. The picture is that of a typical leather bottle stomach. There are a few small white nodules about 3 millimeters in diameter in the wall of the jejunum near the mesenteric border.

The microscopic examination of the ovaries showed the tumors to be characteristic of those described by Krukenberg. The tumor consists of a fibrous connective tissue framework, generally rather loose in the meshes of which are large clear cells. Here and there are collections of cells arranged in solid masses or often in alveolar formation. Some polymorphonuclear leucocytes are also present in places (Fig. 3). A high power magnification shows that these cells have a somewhat eccentrically placed deep staining nucleus, the protoplasm is clear or vacuolated, presenting in some places on this account the signet ring appearance, the vacuole in the cell forming the lumen of the ring and the nucleus the seal (Fig. 4). The protoplasm of these cells in many instances was stained blue with Mallory's aniline blue stain, suggesting a mucoid substance. Stains with scarlet R also showed that many of these cells contained fat droplets.

One of the most striking features of the microscopic examination of the stomach is the excessive growth of fibrous tissue in the wall. Also here and there are collections of large clear cells with an eccentric nucleus, apparently identical with the cell found in the ovarian growths. In many places these cells form acinar structures. A study of the mucous membrane of the stomach shows that while often those portions of the gastric glands near the surface are normal, the lower portions of the glands are transformed into strands of clear tumor cells with eccentrically placed nuclei. In some places these glands still preserve their acinar structure and the cells forming the acini are transformed into tumor cells. Figure 5 shows such a picture and apparently demonstrates quite conclusively that these clear cells are derived from the cells lining the gastric glands. A similar picture was noted by Wagner (loc. cit.) in his case. The origin of these cells from the cells near the base of the glands and their growth downward with extensive connective tissue reaction apparently explains why there is such a marked thickening of the wall of the stomach although the surface appearance of the gastric mucosa is normal. Also it was noted that the tumor cells were very numerous in the muscularis between

the muscle fibers and also were present in the serosa. A study of the section from such a stomach also emphasizes the importance of a microscopic examination before pronouncing a stomach normal in cases of Krukenberg tumor. In its earliest stages this stomach probably would have appeared normal to the naked eye.

Such a tumor presents ideal conditions for the formation of the so called leather bottle stomach. Lyle (42) has made a comprehensive study of this condition which may be of cancerous or of non malignant origin. He has collected 60 cases cancerous in nature and 70 cases of benign origin. Our case is the only one noted in the literature where this unusual condition, the leather bottle stomach, was associated with a Krukenberg tumor. It should be noted however that Welch (43) in 1893 referred to a similar condition of the stomach secondary to a bilateral carcinoma of the ovaries.

A microscopic study of the lymph gland near the hilus of the stomach presented a picture of some interest. A low power magnification of this gland (Fig. 6) suggests very strongly the diagnosis of fibrosarcoma. A higher magnification (Fig. 7) shows however the typical large clear cells with eccentrically placed nuclei surrounded by a dense meshwork of connective tissue.

Such pictures as these which were also noted in the stomach wall and in the ovaries doubtless explain why the Krukenberg tumor was called a fibrosarcoma mucocellulare by its discoverer and why some subsequent investigators like Fischer (loc. cit.) call it a fibrosarcoma. Schlagenhauer (loc. cit.) noted in his studies that one case in his series which had after operation been diagnosed as sarcoma of the ovary showed at autopsy a carcinoma of the stomach with ovarian metastases. Temesvary (44) has stated that in 300 cases of ovarian sarcoma collected by him 3 cases showed at autopsy carcinoma of the stomach and 1 carcinoma of the rectum. Kratzstein (45) reports a case diagnosed as fibrosarcoma of both ovaries which at a later autopsy showed a carcinoma of the stomach. Koetschau (46) similarly reports a bilateral sarcoma of the ovary which showed at autopsy a gastric carcinoma.

In our case the origin of the tumor being apparently from the stomach the method of metastasis remains to be considered. Aside from the lymph gland at the hilus and a few small tumor growths on the jejunum there were no metastases except in the ovaries. The liver so commonly involved in the other carcinomata of the stomach showed here no metastases.

Kraus (loc cit) devotes much attention to the subject of ovarian metastases from gastric carcinoma and emphasizes the importance of surface infection. This idea had been previously advanced by von Recklinghausen (47) and by Mueller (48) and also is strongly advocated by Polano (loc cit).

In our case large sections including the entire ovary tubes and part of the uterus were made. The sections were very instructive and showed the masses of tumor cells to be largest and most numerous in the ovaries. In the tubes also there were small collections of tumor cells but the striking picture here was the marked proliferation of the connective tissue elements. In the uterus no tumor cells were found. This picture suggests very strongly that the tumor invasion began in the ovaries and that the tumor cells were carried by the draining lymphatics toward the uterus lodging in the tubes but apparently not reaching the uterus itself.

In our case a metastasis by means of surface infection suggests itself. The tumor cells were demonstrated in the wall and in the serosa of the stomach and there were a few small tumor nodules present in the jejunum. This might indicate that the tumor cells penetrated the wall of the stomach became free in the peritoneal cavity and then were carried down upon the ovaries. It is hard to conceive of a metastasis by way of the lymph stream since the flow of lymph is away from the ovaries and not toward it and also since the abdominal lymph glands showed no involvement. At first it seemed difficult to assume a metastasis by way of the blood stream since no metastases were apparent in any other organs except in the intestines. Extensive study however of sections from the autopsy showed the occasional presence of groups of characteristic tumor cells in the

pulmonary blood vessels. Also in a few small areas these cells had grown into the lung tissue and formed minute microscopic metastases.

To explain why there is a marked infection of the ovaries and not of the other organs appears somewhat difficult. Schlagenhafer (loc cit) has called attention to the fact that in the majority of cases metastatic ovarian carcinomata occur at an age when the ovary is still functioning. Stone (loc cit) also believes that the changes taking place during ovulation make the ovary more liable to surface infection.

The enlargement of the pituitary gland in our case was very striking and its weight was greatly increased. Microscopically it showed some increase in size of the individual cells suggesting the picture of hyperactivity described for this organ. Schmincke (49) has described a case of ovarian carcinoma secondary to a carcinoma of the intestine in which there was lactation with a pregnancy hypertrophy of the pituitary gland. It is probable that the hypertrophy of the pituitary in our case was similar to that of pregnancy and due to some ovarian stimulus produced by the tumors of both ovaries.

#### CONCLUSIONS

A review of the literature shows that including our own case at least 55 cases of Krukenberg tumor have been reported. To this number may be added 8 probable cases.

Histologically the tumor is essentially a carcinoma. Some features suggest a fibrosarcoma but if this term is to be used it would be more accurate to reverse the order employed by Krukenberg and call it a carcinoma mucocellulare fibrosarcomatodes.

This tumor is in the majority of cases secondary to a carcinoma of the stomach or of the intestines. The question of its primary or secondary nature can only be determined definitely by autopsy or palpation at operation. Eighteen cases were collected in which the presence of a primary growth in the gastro intestinal tract was demonstrated.

Five cases have been reported in which no primary tumor of the stomach or intestines was observed at autopsy. Three of these may



Fig. 1. Ovarian tubal luteal cyst with bilateral tumor of both ovaries.

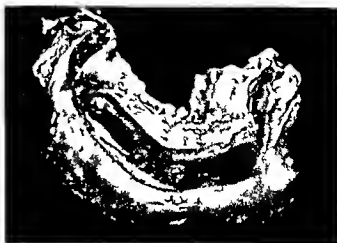


Fig. 2. Stomach with markedly thickened wall.

be open to the objection that no microscopic examination of the stomach was made. Two of the cases at least meet every apparent objection and can not be regarded as other than primary ovarian tumors.

In 43 cases where the data was completed the Krukenberg tumor was bilateral in 39 instances (90 per cent).

Surface infection of the ovaries may explain in some cases the manner of metastasis. In our case however the demonstration of tumor cells in the pulmonary blood vessels suggests very strongly a spread by way of the blood stream. The tumor occurs in the majority of cases during the period of sexual activity — the average age was 36 years.

The statement sometimes made that the Krukenberg tumor is relatively benign is not borne out by the subsequent history of these patients. All of the cases reported in the literature where the later course was known died.

#### CASES CONSIDERED AS PRIMARY

CASE 1. Reported by Krukenberg in 1896. Patient age 6 had bilateral tumor. Autopsy revealed carcinoma of the stomach.

CASE 2. Reported by Krukenberg in 1897. Patient age 43, no autopsy performed. Subsequent history not reported.

CASE 3. Reported by Krukenberg in 1896. Patient age 54 had bilateral tumor. Autopsy revealed a normal stomach.



Fig. 3.

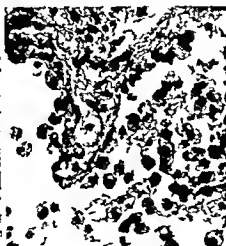


Fig. 4.

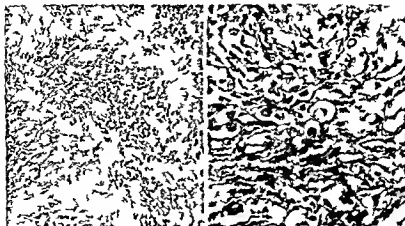


Fig. 5.

Fig. 3. Section of tumor in right ovary. Hematoxylin and eosin stain.

Fig. 4. High power magnification of Fig. 3. Shows the characteristic tumor cells with eccentrically placed nuclei.

Fig. 5. Microscopic view of the stomach showing the infiltration of the mucosa by tumor cells. Hematoxylin and eosin stain.



CASE 17 Reported by Stickel in 1906 Patient age 26 had a bilateral tumor Autopsy revealed a carcinoma of the stomach

CASE 18 Reported by Burdian in 1908 Patient age 26 had a bilateral tumor Autopsy revealed a carcinoma of the stomach

CASE 19 Reported by Ulesko-Stroganoff in 1910 Patient age 40 had a bilateral tumor Cave a clinical history of vomiting No autopsy performed Subsequent history unknown

CASE 20 Reported by Ulesko-Stroganoff in 1910 Patient age 30 had a bilateral tumor Cave a clinical history of vomiting No autopsy performed Subsequent history unknown

CASE 21 Reported by Ulesko-Stroganoff in 1910 Patient age 39 had a bilateral tumor Cave a clinical history of vomiting No autopsy performed Subsequent history unknown

CASE 22 Reported by Cohn in 1910 Patient age 21 had a bilateral tumor gave a clinical history of vomiting Autopsy revealed a carcinoma of the sigmoid

CASE 23 Reported by Cohn in 1910 Patient age 36 had a bilateral tumor Carcinoma of the stomach felt at operation No autopsy performed

CASE 24 Reported by Cohn in 1910 Patient age 39 had a bilateral tumor No autopsy performed

CASE 25 Reported by Cohn in 1910 Patient age 25 had a tumor of the left ovary Autopsy revealed edema of the colon

CASE 26 Reported by Hussy in 1911 Patient age 47 had a tumor of left ovary gave a history of operation in 1906 for cancer of stomach No autopsy performed

CASE 27 Reported by Kuhlmann in 1911 Patient age 27 had a bilateral tumor gave a clinical history of having vomited blood Died No autopsy performed

CASE 28 Reported by Jackson in 1913 Patient age 38 had a bilateral tumor gave a history of operation Operation closed a carcinoma of the stomach Died No autopsy performed

CASE 29 Reported by Mandl in 1913 Patient age 42 had a unilateral tumor Carcinoma of the pylorus No record of autopsy performed

CASE 30 Reported by Hall in 1913 Patient age 3 had a tumor of the right ovary gave a clinical history of miting Autopsy revealed a carcinoma of the pylorus

CASE 31 Reported by Bondy in 1914 No data given

CASE 32 Reported by Bondy in 1914 No data given

CASE 33 Reported by Bondy in 1914 No data given

CASE 34 Reported by Bondy in 1914 No data given

CASE 35 Reported by Stone in 1916 Patient age 28 had a bilateral tumor gave a clinical history of vomiting Died No autopsy performed

CASE 36 Reported by Stone in 1916 Patient age unknown Autopsy revealed a carcinoma of the stomach

CASE 37 Reported by Stone in 1916 No data given

CASE 38 Reported by Reel in 1917 No clinical data given

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# CARCINOMA OF THE UMBILICUS

WITH A REPORT OF TWO CASES

BY FRANK WATNIE, M.D., FAC. C. R. C. OF

CARCINOMA of the umbilicus—other than a primary or secondary neoplasm—is such an infrequent occurrence as to make desirable the careful study of each when encountered. The majority of the cases are secondary in character out of 94 cases of cancer of the umbilicus collected from the literature by Cullen<sup>7</sup> were secondary and primary carcinomas. Of the secondary cases all were derived from some primary malignant epithelial neoplasm of the intra-abdominal or pelvic organs. With so great a difference in the ratio of primary to secondary carcinomas of the umbilicus when a malignant growth of this part is encountered the presumption is that the cancer is secondary to some abdominal or pelvic growth though it may not be possible to demonstrate this fact at the time of the primary examination.

Cancer of the umbilicus seems to be about equally distributed between the two sexes.

Thom. C. R. C. Vol. 1. 111

Of the cases of primary carcinoma of the umbilicus that occurred before the age of 40 the greatest number between 30 and 40 years of age. Here is elsewhere cancer is not a disease of the young.

As the majority of the cases of carcinoma of the umbilicus are secondary to intra-abdominal and intrapelvic epithelial neoplasm the age at which the respective growths most frequently occur is naturally the age at which the carcinoma attack the various organs—viz. in middle or late life.

Of the cases of cancer of the umbilicus secondary to intra-abdominal or pelvic growth the rate of origin of the greatest number twenty-seven was from the stomach. The gall bladder was the primary source of the malignant neoplasm in six cases the ovaries in nine the uterus in two the intestine in four the rectum in one and twenty-three from some abdominal tumor the exact origin of which was unknown as neither operation nor postmortem was made.

The vast majority of the cases which were primarily in the umbilicus were of the adenocarcinomatous type a very few were of the squamous celled variety.

Wohl<sup>1</sup> reported a case of carcinoma of the umbilicus which was secondary to one of the transverse colon.

The embryology of the factus is interesting and essential in understanding the development of an adenocarcinoma occurring primarily in the umbilicus. In the very early days of fetal life the yolk sac is attached to the ventral surface of the fetus. The dorsal portion of the yolk sac forms the primitive midgut which later extends forward to form the foregut and caudally to form the hindgut. The yolk sac now undergoes such a narrowing at the ventral surface as to form the omphalomesenteric duct which communicates with the intestines and is lined with the same type of epithelium. Later as the amniotic cavity enlarges the yolk sac becomes smaller and the omphalomesenteric duct and the body stalk fuse forming the umbilical cord. Later the duct is obliterated and finally disappears. However in some instances remnants of this epithelial duct are left behind which explains why adenocarcinoma of the umbilicus may develop as a primary malignant disease.

The adenocarcinoma secondary to intra-abdominal neoplasms give in a general way the type of glandular structure that composes the abdominal organ in which the primary growth is situated. The umbilical tumor may fail to differentiate clearly the type of cells from which it is derived or the form of glandular structure but both are usually sufficiently formed unless very rapidly growing so one can make a satisfactory estimate of the cell type and the gland origin.

It is not always easy to see just what line of lymphatics are employed for a transmission of cancer cells from the deeper abdominal organs to the umbilicus. But this understanding has been made less difficult since Hanley has shown us that cancer cells may extend into lymph channels by continuous growth and that this growth may take a direction quite against the lymph current.

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FIGURE 1. Case. Cancer of the umbilicus secondary to carcinoma of the rectum.

If this thought is accepted it makes clear the method of secondary transmission of cancer cells to some distant part otherwise the manner in which these detached cells reached these parts by simply being carried in the normal flow of the lymph currents could not be so readily understood.

There are two methods of studying the anatomy of lymph vessels the clinical and the anatomical. The latter method has shown us clearly what was supposed previously that the superficial lymphatics of the umbilicus drain in its upper part into the axillary glands and in its lower into the inguinal glands. While the deeper lymphatic drainage has not been so clearly demonstrated yet recently anatomists have shown that there is a connection between the pelvic lymphatics and the umbilicus. Clinically it is clearly manifest that the lymphatics of the entire gastrointestinal tract and other abdominal organs have some communication with the umbilicus otherwise it would be difficult to explain in our present state of knowledge the transmission of cancer cells from these organs to the umbilicus.

While metastases of cancer cells occur in some situations through the veins and the arteries it seems scarcely possible that a growth in the umbilicus secondary to an intra-abdominal tumor could be induced through other channels than the lymphatics.

The following case of cancer of the um



Fig. 1

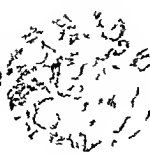


Fig. 2



Fig. 3

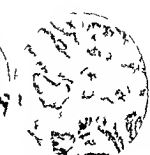


Fig. 4

Fig. 1. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 2. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 3. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 4. C. section of the umbilical artery showing the internal structure of the vessel.

Fig. 4. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 5. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 6. C. section of the umbilical artery showing the internal structure of the vessel. Fig. 7. C. section of the umbilical artery showing the internal structure of the vessel.

bilious condition to a carcinoma of the rectum occurred in my practice. But a single case was found in the literature by Cullen consequently this case of my own added at least a second one to the publication of his recent book on this subject.

On the 17th of May 1901 a patient of 45 years of age was admitted to the hospital.

His history revealed that for a period of three years he had had occasional attacks of pain and soreness in the rectum associated with the attack of diarrhoea followed by constipation. Little attention was paid to these symptoms until the appearance of the history. An examination of the umbilical mass showed it to be a nodule in the intercostal space attached to the deeper wall structure. It was painful and largely free from redness. A digital examination of the rectum revealed the internal structure of the vessel. The diagnosis was made of carcinoma of the rectum with a secondary cancer of the umbilical artery. The patient was operated on for the removal of the primary growth in the umbilical artery and the metastatic nodules in the rectum. The history of all these secondary malignancies in the development of the umbilical artery is usually completely new.

Six weeks from the time of his admission to the hospital the patient died of the disease. The autopsy revealed the presence of the primary growth in the umbilical artery and the metastatic nodules in the rectum. The patient succumbed to the disease after the operation.

The patient died of July 10 and a postmortem was held the following morning. A hard mass was found in the umbilical artery and a section of the umbilical artery was sent for examination. The rectum was also examined and a section of the rectum was sent for examination. The examination of the rectum revealed the presence of the primary growth in the umbilical artery and the metastatic nodules in the rectum. The patient succumbed to the disease after the operation.

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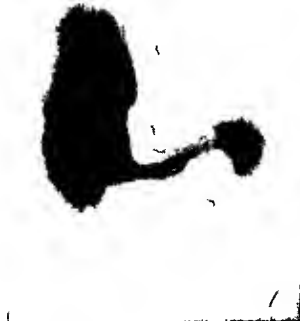


Fig. 6. C. section of the rectum showing the internal structure of the vessel. Fig. 7. C. section of the rectum showing the internal structure of the vessel. Fig. 8. C. section of the rectum showing the internal structure of the vessel. Fig. 9. C. section of the rectum showing the internal structure of the vessel.



Fig. 7

Fig. 7 Case Showing tubular arrangement of epithelium simulating the gland of gastric mucosa



Fig. 8

Fig. 8 Case Showing abundance of fibrous tissue surrounding masses of epithelium



Fig. 9

Fig. 9 Case Showing more clearly the cell group illustrated in Fig. 7

showing some acute nephritis. The heart was normal in appearance with the exception that the coronary arteries presented clear evidence of arteriosclerosis and the inner walls of the heart were the seat of a few fibrous plaques of an old character. While normal the right lung was held down by adhesions at the apex. The iliac artificial anus made twelve days before death had formed very firm adhesions which were holding the colon in position.

The pathological examination of the various specimens demonstrated that adenocarcinomatous masses were present in three situations: in the rectum in the ileum near the head of the colon and in the umbilicus. All three of the masses were of the same character and the tendency in all was to form glandular structure similar to that of the normal rectum. The epithelial cell in the neoplasm were of either a cuboidal or cylindrical type. Many of the nests of epithelial cells in the three growths had undergone gelatiniform or colloidal degeneration placing the growths in the classification of colloidal adenocarcinomatous.

There was no difficulty in excluding the growth in the wall of the ileum as the primary one for the neoplasm was just beneath the peritoneum penetrating slightly the musculature of the intestine but not reaching the submucosa. Left alone the mucosa consequently there were no epithelial cells in this situation from which the cancer could have taken its origin. It was not so simple to differentiate between the rectum and the umbilicus as the point of origin of the original growth. From the fact that the neoplasm in the rectum was much larger, more deeply and broadly infiltrated and showed more extensive colloidal degeneration and was composed of a glandular structure and cell type similar to this organ, the conclusion was drawn that the umbilical growth which was of similar structure and cell type with less colloidal degeneration was

secondary to that of the rectum. Thus the rectum was the original seat of the carcinoma which subsequently metastasized to the wall of the ileum and to the umbilicus.

It seemed a peculiar coincidence that a second case of cancer of the umbilicus should have come into my hands three months after the preceding case just reported when one comes to reflect that in ten years from 1830 to 1840 in 9118 cases of cancer occurring in Paris and two *arrondissements* but two cases of cancer of the umbilicus occurred and but ninety four cases of cancer of the umbilicus are reported from the literature by Cullen.

Mr. Gage 34 was referred to me by Dr. Roll K. Markwith of the Protestant Hospital this city on the first day of September 1901. The patient had noticed a little lump in the umbilicus but a week or two previously. The lump had felt sore rather than painful but the thing for which he sought relief was gastric disturbance which he had noticed for the past six or seven months.

His appetite was poor and he had lost some 20 pounds in weight since he had noticed the stomach disturbance. Vomiting had occurred a few times but was not a prominent feature of his symptoms. Nineteen years before he had some stomach disturbance which gave the symptom complex of ulcer of this organ but the trouble had settled down for all these years until the recent trouble manifested itself.

An examination showed the presence of a hard firm mass in the umbilicus which mass was red and tender on pressure but not ulcerated. At the pyloric end of the stomach was found a large hard mass not very freely movable. The stomach contents

history of the disease is usually a long one, and beyond the pale of hope. If an operation is done sufficiently extensive dissections must be made to give some assurance of a complete removal of the various areas.

It need not be vigorously emphasized that if a mass is encountered in the umbilicus it should not be dealt with as an independent tumor without canvassing with the greatest thoroughness the probability of its being a secondary malignant metastasis from a primary cancer of some intra-abdominal or pelvic organ. Just such a case is no in my hand in which there is a tumor of the pyloric end of the stomach and one in the umbilicus.

At last the treatment of cancer of the umbilicus, either primary or secondary, is not different from the cancer problem in general. To be successful in its treatment an operation must be made early enough to ensure the complete removal of every vestige of the cancer cell, which are continually undergoing mitosis. Every case of cancer is local at the outset and if removed at that early period of its history no recurrence will take place if not operated on until extensive infiltrations have taken place little hope can be entertained of a cure.

The X-ray and radium while helpful in retarding the growth in case of inoperable cancer and in curing some very early superficial carcinomas have no place in the usual treatment of malignant neoplasms; the knife alone, and as the best form of treatment yet devised for cancer in any situation if undertaken early before infiltration have occurred, the results are sure and certain.

I am, Sir, very truly, Yours,  
J. M. S. L.

The prognosis of all the primary cases of carcinoma of the umbilicus is good provided an operation is undertaken before infiltration beyond the reachable reach of an operation to remove both the growth and the locally infiltrated area; the outlook, however, is very unfavorable in secondary cancer of this situation because the infiltration is likely to have extended in other directions than the umbilicus, the original abdominal neoplasm having metastasized into other regions of the cavity, as in the case reported by me.

When an umbilical carcinoma has metastasized from some intra-abdominal growth the patient usually quickly succumbs.

The treatment to be efficient must be undertaken early in the case of the primary cancer of the umbilicus, in those of a common

type the disease has usually advanced beyond the pale of hope. If an operation is done sufficiently extensive dissections must be made to give some assurance of a complete removal of the various areas.

It need not be vigorously emphasized that if a mass is encountered in the umbilicus it should not be dealt with as an independent tumor without canvassing with the greatest thoroughness the probability of its being a secondary malignant metastasis from a primary cancer of some intra-abdominal or pelvic organ. Just such a case is no in my hand in which there is a tumor of the pyloric end of the stomach and one in the umbilicus.

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## EXTRAPERITONEAL CÆSAREAN SECTION IN CERTAIN INFECTED CASES WITH THE CARREL AFTER-TREATMENT

By J. W. MARKOE M.D. F.A.C.S. AND ROSS McPHERSON M.D. F.A.C.S. N.Y.  
 From the New York City Hospital, First Division

TRUE extraperitoneal hysterotomy has been performed so seldom in this country that for the operative indications to be fully appreciated it seems best to describe the cases where its adoption appears essential to accomplish certain results namely a living mother capable of bearing other children and a living child in a patient already infected where the only other possible choice is a craniotomy on the viable fetus or an amputation of the uterus supra-vaginally treating the stump extraperitoneally in which case as a matter of course no further pregnancy can ever occur.

J. Whitridge Williams in the November number of the *Johns Hopkins Bulletin* publishes an article entitled "A Histological Study of Fifty Uteri Removed at Cæsarean Section." In this he has contributed most important data on the placental site and the details of placental separation but of even more interest were the findings of inflammatory processes in the decidua. So pertinent were they to the subject of this paper that I quote him in full:

In the first section of the article attention was directed to the fact that in 8 instances the indication for the removal of the uterus consisted in frank intrapartum infection. In all these cases microscopic examination revealed the existence of acute inflammatory changes in the decidua. In every instance the process was most intense in the lower uterine segment thus indicating that the infection had ascended from below. In a number of instances the placental site was involved in the process and there is every probability that a considerable number of the women would have presented severe if not fatal infection in the puerperium had the uterus not been removed and thus additional evidence is afforded of the wisdom shown in adopting a radical course. In addition to the eight cases just mentioned definite inflammatory changes were noted in twelve other specimens. These were all derived from patients who had been examined by outside physicians before admission to the service or in whom for one reason or another interference had been deferred until late in labor. In a number of these specimens appropriate methods of staining

enabled us to demonstrate the presence of streptococci in the tissues but in others such bacteriological evidence could not be adduced.

The fact that inflammatory changes were present in 40 per cent of our specimens is very impressive and serves to demonstrate anew the dangers of conservative cæsarean section when performed at any other than the optimal time namely at an appointed date during the last days of pregnancy or within a few hours after the onset of labor in patients who have recently been examined only by those who observe an appropriate technique. In this group of cases at least I feel that the disadvantages incident to permanent sterilization have been more than compensated for by the increased saving of material life resulting from the radical operation.

In our series of classical cæsarean section we can recall at least three cases where before the operation there were no signs of infection or history of interference and yet they promptly died of a rapid septic infection with general peritonitis. This might have been laid to poor technique but for the fact that cases before and after under the same conditions made uninterrupted recoveries.

At the present time the authors are limiting the use of the extraperitoneal operation to cases that present the following combination of conditions: a living child in a patient who is presumably infected and cannot be delivered of that living child through the normal passages.

It is our belief that these conditions contraindicate first craniotomy or other vaginal interference for the operation of craniotomy was performed 40 times in the service of the Lying In Hospital in 60,878 births and of the 240 mothers operated upon 30 or 15 per cent died with naturally a foetal mortality of 100 per cent second classical cæsarean section third amputation of the uterus after cæsarean fourth transperitoneal cæsarean section.

We feel that it is virtually impossible to have the peritoneal cavity open and not to infect it when the septic contents of the

uterus must necessarily invade everything in the immediate surroundings at the time of the removal of the child and placenta from the uterine cavity for the liquor amni will most surely find its way to the general peritoneal surface in such quantity as to certainly infect it.

In the autumn of 1914 the author returned to the United States from a visit to the principal centers of clinical medicine in Italy, Switzerland, Germany, Denmark, England and France and became deeply impressed with the work being done in obstetric cases where the mother had become infected, the unborn child still alive and the possibility of delivering this child by way of the natural passages out of the question.

At that time Frank and Selheim had done most of the work along this line and their results were most interesting.

About the same time Hirst of Philadelphia published his report in *Modern Extra-peritoneal Cesarean Section* and in this article advocated a transperitoneal method that was extremely easy to do by suturing the peritoneum at the edge of the abdominal wound to the edge of the uterine peritoneum before opening the uterine cavity. At the same time it was claimed that this isolated the general peritoneal cavity from any infection that might arise from the removal of the child through the uterine wound, compared as it always is with a great gush of liquor amni and uterine contents all more or less infected.

Inspired by his success Markoe performed five of these transperitoneal operations.

**CASE 1.** Hopeless case of toxemia of pregnancy, verified by autopsy. The patient had been in the hands of a midwife and two physicians. In this case the mother died in one and one half hours after operation and the child was stillborn.

**CASE 2.** A justborn normal pelvis who had been in labor eighteen to twenty hours and whose private physician had made innumerable attempts at delivery before sending her to the hospital. A culture from the vagina was taken when this patient was admitted and showed *colon bacilli*. On the sixth day the abdominal wound broke down and a culture from it showed *staphylococcus albus*. Mother and child were discharged well.

**CASE 3.** Contracted pelvis with a history of interference before entering the hospital. This

patient was infected evidently but cultures and smears were not taken. A histological examination of a section of the endometrium removed at the time of the operation showed an acute exudative inflammatory process. Her future course was an extremely stormy one and she died on the third day. Postmortem inspection of the wound showed a general peritonitis with an infection by *hemolytic streptococci* and *colon bacilli*. The child lived fourteen days and died of malnutrition.

**CASE 4.** Was a case of contracted pelvis in which her home physician had tried for three days every method of delivery and then sent her to the hospital. The contracted pelvis was demonstrated by a living child induced the selection of a transperitoneal cesarean after the method of Hirst. This was done and the patient made an uneventful recovery but the child survived only two hours. It weighed 4700 grams.

**CASE 5.** Was similar to the last case but with no general infection. The wound healed properly and both mother and child were discharged well.

This is the summary of the five cases all delivered by opening the lower abdomen, suturing the uterine and parietal peritoneum together so as to wall off the general cavity before opening the uterus and removing the child.

One mother died from toxemia and one from sepsis and the three children survived but to the writers the only case which showed the danger of the operation was Case 3. Here was an unknown far advanced infection of the endometrium which at the time of the operation undoubtedly leaked through the unavoidable openings made by the sutures and no matter how carefully they were applied this could not be prevented. Therefore after careful consideration it was decided that in future in all such cases the true extraperitoneal operation as done by Frank and Selheim would be performed. Accordingly on January 16, 1915 the first of these operations was successfully carried out. In the September number of the *Bulletin of the Living in Hospital* Markoe published a report of four cases and a summary of them shows the following:

**CASE 1.** Mrs. A. B. age 33, VIII para born in Italy. Admitted to hospital on January 16, 1915. The patient was examined and rather. The head was above the brim. It was decided that she could not be delivered vaginally as the pelvis was generally contracted and flat. On the afternoon of Janu-

ary 16th the patient was again etherized and the abdomen opened in the median line from the pubes to the umbilicus. After passing through the fascia and separating the recti muscles the bladder was exposed but not opened and found to contain a small amount of urine which was of a decided advantage. By blunt dissection the fascia was separated from the peritoneum and the anterior wall of the bladder laid bare almost down to the urethra. Moderate bleeding occurred from the plexus of veins just posterior to the symphysis. The peritoneum at the fold formed by the juncture of the parietal and visceral layers was then dissected up. The bladder was loosened posteriorly and carried over to the right of the median line. It was then held out of the way by the fingers. The peritoneum was next dissected up farther on the anterior wall of the uterus so as to give sufficient room to extricate the child. On the anterior wall of the uterus a small vein was caught and tied. This was the only vessel of any size on the anterior wall of the lower uterine segment. All the dissection was done by the use of gauze and fingers. An incision 10 centimeters in length was then made in the lower uterine segment. The uterine wall was very thin and not very vascular. Because of this thinness a small cut was made in the baby's scalp. Using the left blade of the forceps as a vectus the head was raised through the incision and the body of the child delivered. The cord was clamped and cut. The child weighed 5810 grammes. There was a large amount of meconium in the uterine cavity. The placenta was delivered manually. The uterus was relaxed and filled with blood but by pressure through the abdominal wall and packing the fundus with gauze the uterus contracted and the hemorrhage ceased.

The uterus was then closed with two layers of interrupted sutures of No. 2 chromic gut. After the packing was removed. In freeing the bladder from its anterior attachments a space about 3 centimeters deep just posterior to the symphysis remained. In this space was placed a large cigarette drain which was brought out through the lower end of the incision. The bladder was then returned and sutured in place with continuous sutures of No. 1 chromic gut. A rubber tube containing iodoform gauze was placed above the bladder and to the right and brought out just above the cigarette drain. The fascia was closed with interrupted sutures of No. chromic gut leaving a space for drains. Two silk worm gut sutures were inserted one above the other and one below the drains and they were tied in bow knots. The remaining skin was drawn together with skin clips. Culture from uterine cavity through the incision subsequently showed a staphylococcus aureus and a non hemolytic streptococcus. The subsequent history of this case was that the child lived three weeks dying of septicæmia and upon autopsy showed the same staphylococcus aureus and non hemolytic streptococcus which developed from the culture taken from the uterus of the mother at the time of opera-

tion. The mother made a complete recovery and was discharged perfectly well.

CASE A Y age 30 III para A N 49618  
This patient was admitted to the Lying In Hospital on March 20, 1915 with the following history.

On November 2, 1913 the patient was admitted to the hospital. She was delivered of a living child by the author by a transperitoneal cæsarean section after outside interference by midwives and doctors. At that time the abdominal wound broke down but it did not involve the peritoneal cavity and the woman made an uneventful recovery. In March 1914 she had a three months abortion and on March 28, 1915, notwithstanding the fact that she had been warned to come to the hospital at the slightest sign of anything being abnormal she had a severe hemorrhage accompanied with slight uterine pains in her own home. So severe was the loss of blood that she fainted at the time. The following day March 29, 1915 at 2 a.m. she was admitted to the hospital in an intensely anæmic condition with a rapid pulse. The cervix was immediately packed with iodoform gauze and means were taken to improve her general condition. Later the same day an extraperitoneal cæsarean section was decided upon in spite of the fact that the patient was in a very serious condition from loss of blood.

Ether was given which the patient took very badly. The abdomen was rapidly prepared with iodine an incision was made through the former old scar which was removed. The incision was carried through the fascia just above the symphysis. The old scar tissue was very thick but after passing through the fascia the recti muscles were easily separated and drawn aside the peritoneum being exposed but not opened. The bladder was then loosened from its attachment on the left side and drawn over to the right. There was very little bleeding from the prevesical plexus of veins. The peritoneal fold to the left side was then loosened drawn up and over to the right side so as to expose the lower zone of the uterus. The uterine wall which was very thin was then opened in the median line coming directly down upon the placenta with very profuse bleeding and although the delivery was made in the most rapid manner by passing a hand through and grasping a foot as the breech presented the baby was easily delivered but the severe hemorrhage was caused by the extremely adherent condition of the placenta to the lower uterine segment. These adhesions had to be broken up and the placenta was removed in pieces with great difficulty. The iodoform gauze from the previous night was removed from the vagina and the opening in the uterus was rapidly closed with interrupted chromic catgut No. 2 this suture being then buried thus securing the incision. The bladder was then drawn over to the left side and attached with plain catgut No. 2. One large cigarette drain was placed back of the symphysis and one rubber tube down to the fascia. The fascia was closed with



interrupted chromic catgut No 2. Silkworm gut sutures were then passed and tied. Michel clips were used in the skin. The patient was in such poor condition at this time that she was infused with 900 cubic centimeters of normal salt solution notwithstanding that one and one half hours after the operation she died from shock, following the hemorrhage she had had at her own home and the hemorrhage from the placental site at the time of operation. Transfusion was impossible because of our inability to procure a donor on such short notice and as she died so soon after operation the question of septic infection did not enter into the case.

CASE 3. A G age 20. Para 1. N 4. The patient was admitted to the Lying-In Hospital on May 17, 1915 with the following history:

The patient was brought to the hospital in an ambulance in active labor three fingers dilated, membrane ruptured and fetal head not engaged in the pelvic brim. Examination showed a just-minimal pelvis. I t l heart good, 50 per minute left and below. The patient had been under the care of a midwife in active labor for the twenty-eight hours. The membrane had been ruptured for eleven hours with frequent examinations by the midwife and assisted by the physician that she had called to help her. An extraperitoneal cesarean section was decided upon.

Vaginal culture negative. The vagina was scrubbed and abraded with iodine. A median incision was made just above the symphysis to the umbilicus. The recti muscles were separated and the bladder and peritoneum exposed. The bladder was dissected to separate the left side and drawn over to the right side. The peritoneal fold was lifted up from lower left reflection and the cecum, the uterine wall exposed and incised. The baby's head was just below the opening. Using one blade of the forceps as a vectus the head was brought up and out of the incision and the child was delivered. It cried spontaneously. The placenta was removed manually. The assistant followed the uterus down with very slight bleeding. The uterine wall was closed with interrupted chromic catgut No 2 which was covered over with a running suture. A culture was taken from the incision. The bladder was then drawn over and fastened down to the left side. A cigarette drain was put in the lower end of the incision. The fascia was closed with interrupted chromic catgut No 3 and four silkworm gut sutures were placed through the abdominal wall. The skin was closed with Michel clips. The patient was in good condition and the case was but slight shock from the operation. She ran some temperature which reached 101 on the fourth day after operation and the abdominal wound broke down but the peritoneal cavity was not contaminated. The baby weighed 4280 grmme and developed a small abscess on the head but under proper care this rapidly healed. Both mother and child were discharged well on the thirty-ninth day. Cultures

taken at the time of the operation from the vagina and uterus showed staphylococcus aureus.

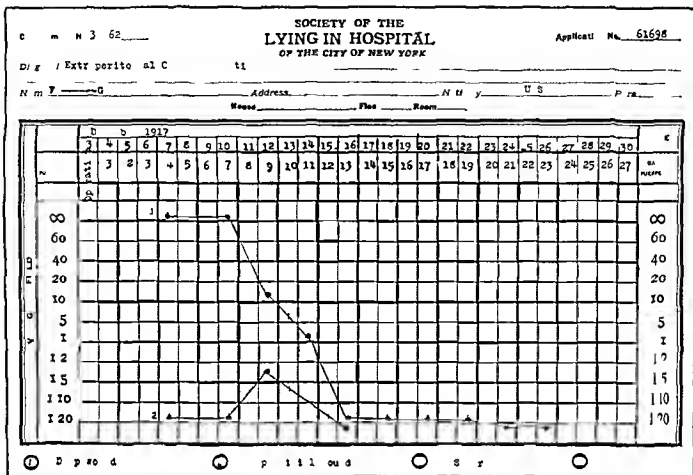
CASE 4. S F age 22. Austrian. A N 50303. Previous history negative. Admitted to the hospital on May 16, 1915 with a history of prolonged labor (40 hours) under the care of a private physician who examined her and found a short diagonal conjugate and the head above the brim and then ruptured the membranes. He called in a consultant who repeatedly examined the patient. She was then sent to the hospital. Upon admission her temperature was 101 pulse 96 respirations 22. The cervix was four fingers dilated and somewhat thick. The fetal head was at the brim with large caput projecting into the pelvis. Extraperitoneal cesarean section was decided upon because of a flat pelvis.

Operation. Ether anesthesia given. The vagina and thorax scrubbed with iodine. The abdomen was prepared. A median incision was made from the symphysis to the umbilicus. The fascia, peritoneum and recti muscle separated. The bladder and peritoneum exposed. The bladder was lifted from its attachments on the left side and drawn over to the right side of the median line. The reflection of the peritoneum as drawn up from the lower left fold and uterine wall exposed. Several large vessels were exposed along the left pelvic wall. As the peritoneum was being dissected up a small opening, as made in the fold which was immediately sutured with fine chromic catgut. The uterine incision was made just to the left of the median line. The case was very little hemorrhage. The baby's head was exposed in L O P position. Using a blade of the forceps as a vectus the head was brought up and through the incision with great difficulty. The baby was delivered in a somewhat anemic condition. Moderate hemorrhage. Manual traction of placenta. A hypodermic injection of ergotol as given. The incision in the uterus was closed with chromic catgut No 3 interrupted sutures. A running suture of No 3 chromic catgut closed these over and buried them. The wound was abraded with iodine solution. The bladder was drawn over to the left and sutured with interrupted sutures. The ureter was exposed on the left side for a distance of about 5 centimeters. The vessels were covered over with fascia. Large cigarette drains were placed in the lower angle of the wound. Fascia was then drawn over overlapped and sutured with chromic No 3 interrupted suture. Four silkworm gut sutures were passed and tied in book knot. The skin was closed with Michel clips.

Culture from the uterine cavity and abdominal wound at the time of operation showed staphylococcus aureus.

The patient was compelled to remain in the hospital for 4 days as the wound was infected and healed slowly.

The baby lived three days and died of atelectasis. Cultures from the heart's blood taken post mortem showed streptococcus.



Bacteriological Chart December 3 1917 Culture from uterine wound (Case 1 F G) shows colon bacillus and nonhemolytic streptococcus

The following case is reported by McPherson

CASE 5 C S age 37 I para C N 36,98 Admitted to hospital March 22 1917 On admission the patient gave the following history She had been in labor 30 hours and had had several forceps application by local physicians without success On examination here the patient showed a generally contracted pelvis with a large fetal head partly molded into the inlet but with greater part of head not engaged cervix practically fully dilated baby evidently alive as fetal heart could be heard

As it was obviously impossible to extract a living baby through the pelvis an extraperitoneal hysterotomy was done abdomen prepared with iodine preparation 6 inch skin incision extending from just below umbilicus to symphysis pubis fat pushed to one side fascia opened and recti muscles removed to either side by retraction space of Retzius exposed and bladder thus brought into view bladder then pushed aside upward and to the right thus exposing vesico uterine pouch This was stripped upward to its junction with abdominal peritoneum so exposing the lower uterine segment in which head of fetus was readily palpated A 5 inch incision was made

through the lower uterine segment and the fetus removed with some difficulty by using the forceps blade as a vectus and aided by hands of operator The placenta was readily removed The uterus was closed as usual with interrupted plain No 3 catgut sutures to inner layer and modified Lambert to outer row The bladder was put back into place but not fastened down The abdomen was then closed leaving a cigarette drain extending through the lower end of the incision area down into the vesical pouch and a piece of rubber tissue was placed in the fatty layer just beneath the skin The fascia was closed with interrupted chromic mattress suture The skin was closed with silkworm and clips Dry dressings were placed about the drainage tube and a tight many tailed binder applied The patient was returned to the ward in excellent condition

The fetus upon delivery failed to respond to any attempt at resuscitation

Convalescence was uneventful The wound broke down only in part

The patient was discharged on eighteenth day She had at that time a small sinus which healed rapidly Culture and smears were not made in this case

Dissatisfied with the protracted convalescence of these patients owing to the slow granulation and closure of the wounds we sought a method which would give us more rapid results. We therefore gladly welcomed the plan of Carrel which he has so successfully used on suppurating wounds.

Although weeks of study had nearly fitted us to apply the Carrel Dakin method to the following cases they came so unexpectedly that we were unable to install the irrigation tubes at the time of operation as we now believe should be done in the future cases. Nevertheless we feel that the late introduction of the method has shown such hopeful results that we publish the following three cases.

The following are reported by Markoe.

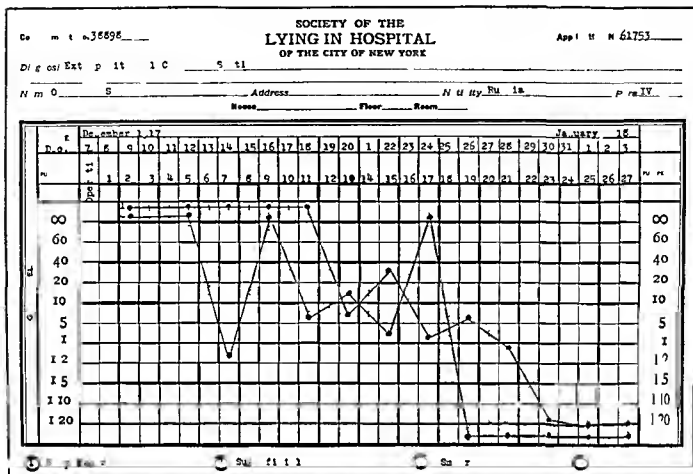
CASE I. F. G. age 25 U. S. I. para 1 N 61698. Admitted to the hospital on December 2, 1917 with a history of having been in labor for nearly forty-eight hours.

She sent for her physician but before he came a nurse came and examined her three times. Then the physician called examined her and left her in charge of the nurse who gave her pills which deadened the severe labor pains that she was having. She states that the nurse made repeated vaginal examinations throughout the night. Early the next morning the physician returned and made two more vaginal examinations and then called a consultant who made another examination with the addition of a careful examination of the pelvis and immediately advised that she be sent to the hospital. She was admitted at 9 a.m. on December 3. It was noted that the nurse had given her two enemata and several doses of quinine. Examination on admission showed a woman considerably exhausted with an abdomen that contained a full term fetus, the fetal heart 140 to the left and below the pelvic measurements showed the pelvis to be just normal. Vaginal examination after culture had been taken showed the cervix four fingers dilated and soft, the membrane ruptured and most of the liquor amnii drained away. The head had made no progress in engaging at the brim as there was no possibility of it coming through. As soon as she could be prepared she was taken to the operating room and ether administered to the surgical degree. The abdomen was prepared by the iodine method, an incision 18 centimeters was made in the median line from the symphysis up to the umbilicus. After passing through the fascia and muscle great care was taken not to enter the peritoneal cavity but by the use of dry sponges the tissues entering the bladder were stripped up from the left side until the side of the uterus was reached. This was then

further stripped back so that the anterior wall of the cervix was exposed over a large enough space to allow the delivery of the child. The bladder and peritoneum were then held by an assistant well to the right the uterus incised and the head of the child brought into view. This was easily extracted by using one blade of the forceps as a vectus and the child quickly delivered. The placenta and membranes were manually extracted and the uterus wound sutured with interrupted chromic gut sutures after a culture and smear had been taken from the uterine cavity and also from the wound. The bladder and peritoneum still unopened were then replaced and held to the left side by one suture, a deep rubber drain was inserted on the left side and the wound closed with interrupted chromic sutures in the fascia and deep to the skin. Dry dressings were applied. The operation lasted 40 minutes and caused no shock to the patient.

On the following day the canal tubes were for the first time introduced into the wound. Although only 26 hours had passed since the operation the wound contained pus and evidently was not going to heal by primary union. Therefore there were introduced into the deep pocket on the left side two canal tubes, No. 5 and two on the surface of the wound which were surrounded by pieces of gauze wet in Dakin fluid. The nurse was ordered to allow a small amount of the fluid to soak into the dressing through the canal tubes. This method did not procure the results desired and on the advice of Doctor Loebe and Major Stear of the War Demonstration Hospital of the Rockefeller Institute the nurse was instructed to flush the wound every 4 hours with 100 cubic centimeters of the Dakin fluid. This gave an immediate clearing of the wound and a marked drop in the number of bacteria per field. So rapid was the healing that the upper portion of the wound was drawn together with a strip of adhesive five days after the operation. Twelve days after the operation all tube were removed and the lower wound closed successfully. The patient is up and about and has no discomfort.

CASE II. O. S. age 35 IV para born in Austria. Admitted to hospital on December 7, 1917 stating that she had been in labor for 44 hours that so on after her labor pains began she sent for her family physician who washed his hands in some solution and then examined her and told her that the child was lying crossways. He then sent for another physician who examined her and they decided that she was a proper case to send into the hospital. Examination on admission showed a woman much exhausted with a temperature of 102.8 and a pulse of 130. The pelvis was slightly just normal, cervix three fingers dilated, membranes ruptured, head not engaged and evidently the liquor amnii had been largely drained away. Before the patient was seen by Markoe an attempt was made to promote the engagement of the head by placing her in the obstetric chair but as this had no effect no further effort was made until his arrival.



After reviewing the history of repeated examinations and the fact that the head would not engage and the fetal heart was plainly heard it was decided to perform a true extraperitoneal cesarean section. Accordingly she was rapidly prepared the abdomen being painted with iodine. An incision was made from the symphysis to the umbilicus in the median line down through the fascia and muscle to the preperitoneal fat. The whole peritoneum formed of the parietal and visceral layers was pulled to the right by blunt dissection great care being taken not to open into the peritoneal cavity or to injure the bladder or ureter and further retracted to the right side until the anterior wall of the cervix was exposed to a sufficient extent to allow the head of the child to pass. An incision 10 centimeters in length was then made into the uterus exposing the child's head. One blade of an obstetric forceps was used as a vectis and the head easily extracted after which the shoulders and body were delivered and the child handed to an assistant. The placenta was then manually extracted and the fundus of the uterus followed down by another assistant to control the moderate bleeding that followed. The opening into the uterus was then sutured with interrupted chromic sutures and the bladder and

peritoneum brought back to the left side and caught with a single stitch. A large rubber drain was placed down on the fascia and the skin closed in the usual manner leaving a place for the drain at the lower angle of the wound. A dry dressing was then applied and the patient returned to the ward. Unhappily all efforts to resuscitate the baby that weighed 3100 grammes were without avail. The patient rallied fairly well from the operation but had to be catheterized and was so restless that morphine was given from time to time. Her temperature the following morning was 100.2 F. pulse 120 respirations 26 with considerable cough and some purulent expectoration. Two days later the wound was bathed in pus and as it was evident that it was infected the drain was removed and the wound laid open. The smear from the uterus taken at time of the operation showed streptococci non hæmolytic. The Carrel tubes were then inserted two into the deep position on the left side and two into the more superficial area. The mistake was made at first in not allowing enough of the fluid every two hours to flush through the tube but after the use of 100 centimeters every two hours the wound started to clear up. Another mistake was made in using the tubes covered with Turkish toweling so that several

days passed before the real value from the proper use of the tube and solution was discovered. Then the results were really wonderful and as the bacterial count became less the wound was brought together by the use of adhesive strips. About the seventh day her bladder was found to be greatly distended and although she catheterized every six hours a leak was found from the bladder up to the urethra in this case very young man the case was introduced with good result.

CASE 3. C. M. age 19 para 0 N 38941

Admitted November 4, 1910. This patient had been in labor since when first seen. The membranes had ruptured and the head was only partly engaged. The fetal heart was running between 160 and 165. The patient's temperature was 100.5 F. 111 pulse 13. She had had a chill 24 hours prior to operation with temperature 102.

High grade infection of the form of an intra-uterine infection. The patient was anesthetized the cervix dilated almost fully and forceps applied and delivery attempted. The head could not be brought through the brim. An extraperitoneal hysterotomy was decided upon. This was done in the usual manner. The abdominal wall was opened and the fascia incised and the muscles separated. The bladder was retracted to one side and the peritoneal fold retracted up and the head was extracted by forceps rather easily. A living baby was cured. The placenta was removed. The uterus was sutured with interrupted No. 2 catgut. At this time a small hole in the posterior wall of the bladder was discovered and repaired. The peritoneum was closed in the usual manner. A cigarette drain was placed in the lower angle of the incision and a dressing applied. The patient was in considerable shock due to extensive hemorrhage caused by the uterus filling up. Intravenous saline and other regular methods of stimulation were given to which the patient responded. She was then returned to the ward and reacted fairly well for the first three days when her temperature began to rise and the entire wound opened up. Ordinary methods of treating the patient did not improve. She was placed on the Carrel Dakin treatment which caused an immediate improvement in the superficial appearance of the wound. The tear in the bladder loughed forming a vesical fistula. This was kept pretty under control by a self-retaining catheter placed in the bladder. Notwithstanding the enormous leak the temperature kept down until the thirteenth day when it arose to 103 F and the patient died on the eighteenth day of general peritonitis. Post-mortem examination of the wound showed very little attempt at healing in any direction except near the surface. Infant died on labor day. Cultures were taken from the uterus at the time of operation and showed colon bacilli.

This was undoubtedly one of those cases in which the infection had already penetrated the deeper tissues before operation. No treat-

ment has as yet been devised that is of any aid in such conditions.

In the first five cases no attempt was made to disinfect the wound at the time of operation or immediately after as the Carrel method had not been tried at that time. Although thorough drainage was adopted the wounds were slow in healing making the convalescence hard on the patient from the frequent and somewhat painful dressings.

With the advent of the Carrel Dakin treatment of infected wounds it seemed possible so rapidly to sterilize these wounds that a study of its technique was begun at the War Demonstration Hospital of the Rockefeller Institute which is directly under the supervision of Carrel.

Weeks were spent by Markoe in visiting the wards and studying the methods and results and with the assistance of Miss Margaret Kearney a graduate nurse of Johns Hopkins he was able to duplicate the apparatus necessary for its application and after this had been procured and verified the treatment was begun.

When the rudiments were mastered and the necessary apparatus assembled we considered it safe to apply it to such cases in the wards of the Living In Hospital as might present themselves. In order that the staff and the nurses might become familiar with the details all wounds in one of the small wards were treated by this method. Gradually they became interested in the results shown by the bacteriological charts and as soon as their interest was aroused they entered into its perfection with zeal.

Not having used any intra-uterine treatment in puerperal cases for many years and owing to the great improvement in our mortality and morbidity in consequence we have not as yet seen an appropriate case in which to use the ingenious instruments devised by Sherman of Pittsburgh but they are ready on our tray for immediate sterilization and application. Postpartum pyelic endometritis comes to us rarely in the city and in a personal communication Sherman states that it is only in such cases that his irrigation instruments are applicable.

On the other hand cases where midwives



Fig. 1 (left). Model consists of a normal bony pelvis with uterus and bladder that were removed postmortem from Case 3. This patient died of a general systemic infection. (right). Shows method of retracting bladder in order to expose exterior of uterus.

or doctors have attempted to find the reason why the child is not born in the usual length of normal labor come to us with a history of repeated vaginal examinations even the application of forceps has been attempted in pelvis through which no child could be born. But this fact has not been recognized by them until in their unavailing efforts they have hopelessly infected the vagina and cervix and all too often by the rupture of the membranes infected the liquor amnii and endometrium as well.

These are the desperate cases that are as a rule not very ill at the time they are admitted to the hospital but in whom if a

lacerating operation such as forceps version or even craniotomy is attempted penetrating as they nearly always do the broad ligaments the bacteria invade the lacerations and rapidly cause a very far reaching sepsis that all too often proves fatal. Once the infection has penetrated the broad ligaments and involved the venous plexus and lymphatics as in McPherson's last case any treatment will not be of much benefit.

To recapitulate then. The cases to which in our opinion the extraperitoneal cesarean section combined with the immediate use of the Carrel-Dakin method is applicable are those that present the following combina-

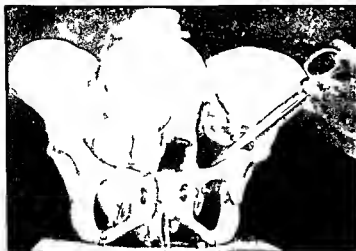


Fig. 3. Scissors point to space from which the bladder has been retracted.



Fig. 4. The opening of the uterus to reveal the fetal portion of the uterus and extraperitoneal.

tion of conditions a living child in a patient who is presumably infected and cannot be delivered of that living child through the normal passages

In all such case we believe that it is criminal to wait until the fetal heart has ceased to beat and then to perform a craniotomy and furthermore even if the child is thought to be dead and a craniotomy performed the laceration of the septic cervix is almost certain to extend into the broad ligament with consequent rapid general infection

The clisical and transperitoneal sections are we believe extremely dangerous and the immediate removal of the uterus with the treatment of the stump extraperitoneally preclude the possibility of the woman ever having another child

It seems to us that all of these objections are met by the adoption of the extraperitoneal operation for the incision into the uterus on the interior wall away from the broad ligaments and is extraperitoneal and the number of children saved by this method is equal to that of any other method. The peritoneum is not involved and unless some other complication such as infection which has already invaded the broad ligaments, toxemia, hemorrhage or extreme exhaustion from protracted labor complicates the case the convalescence is more rapid and accompanied with less discomfort than any

transperitoneal operation. Lastly the woman is not sterilized and if the child should not survive she has a chance to have another at a later date

The objections are that it appears to be a more formidable operation than it really is but to the surgeon who comprehend the anatomical surroundings it is as easy as any other capital operation. The very fact of pregnancy with its consequent loosening up of all the tissues in the pelvis simplifies the tripping up of the unopened peritoneum from over the surface of the enlarged lower zone of the uterus. With the advent of the Clisical method of immediate and continued disinfection of the wound the dangers should be greatly minimized. Caution must be exercised in drawing the tissues containing the bladder and unopened peritoneum to the right side for it is easy to penetrate the peritoneum or cause a rent in the bladder. Any opening in the bladder heals rapidly as the bladder be drained and the upper wound kept aseptic while a small accidental opening into the peritoneum is much less dangerous than in transperitoneal operation.

That this operation is not one to be adopted by the general practitioner but only by those with hospital facilities and surgical experience goes without saying. Under these circumstances however we believe it offers great possibilities for good result in the class of case described.

## LIPOMATA IN SARCOMATOUS TRANSFORMATION

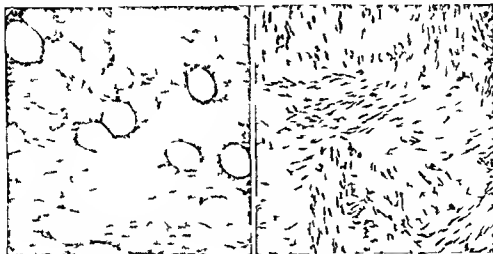
### REPORT OF TWO CASES

By HILLIOPOL SCHILLI, M.D., CINCINNATI

**L**IPOMA is strictly a benign growth. Malignancy in a lipoma is of rare occurrence but it has been observed. I recently saw two cases of lipomata with sarcomatous degeneration which I shall report briefly.

**CASE I.** Mrs. R. age 67, as operated on in 1906 in the Mayo Clinic of Rochester for multiple

(thel) lipomata. About 10 years later the appeared in the middle of the scar of one of the lipomata which had been operated on a slowly growing tumor of apparently the same nature as the previous growth. Eight weeks ago the growth began to cause pain and therefore the patient saw a physician. On examination there was found just below the left mamma a linear scar of 5 inches in length elevated by a tumor the size of an orange. The tumor presented all the clinical signs of a



Case 1

Case 2

lipoma except for a hard somewhat tender nodule in the center the size of a plum. Extirpation was advised and done the next day. Macroscopically the specimen is a lipoma the size of an orange. In its midst is a hard whitish yellow nodule ovoid in shape 3 x 4 x 4 centimeters rather sharply defined and demarcated from the surrounding fat but having no capsule. Microscopically there is a picture of a fibrosarcoma or fibroma sarcomatosum. There are spindle cells in bundles with little intercellular substance few blood vessels there is a distinct difference in the size of the cells large small broad and narrow ones also a difference in the nuclei.

It is singularly difficult to draw the line between a fibroma proper and fibroma sarcomatosum between the typical and atypical connective tissue tumors. We must take into consideration the tissue in which the tumor originates. If the tissue is rich in cells we would call the tumor growing in it a fibroma. The tumor in question however originated in a lipoma was very rich in cells showed a pronounced difference in the size of the cells and showed little interstitial fibrillae which justifies the diagnosis fibroma sarcomatosum.

**CASE 2** Mrs. O. age 67 had noticed for many years the presence of a tumor on the thigh some what above the knee. A number of physicians had diagnosed it as a lipoma. Six weeks previously it began to be painful. The tumor was the size of an egg with all the clinical signs of a lipoma but containing several hard nodules. Extirpation was advised and performed the next day. The tumor was the size of an egg and had the general appearance of a lipoma. In the tumor itself were three hard nodules the size of a hazelnut not well defined

from the surrounding lipomatous tissue rather hard in consistency and reddish gray in color. Microscopically it was a typical spindle cell sarcoma developed on the basis of a lipoma.

In this connection I wish to report a third case which on account of its clinical similarity not on account of its pathological findings well fits into this group.

Mrs. N. age 65, noticed for many years a tumor in her left axilla which gave no evidence of its presence. She did not remember whether it had enlarged during menstruation as she had been amenorrheic more than 10 years. At different occasions she had showed it to physicians who called it a fatty tumor which she as it never grew should leave alone. Recently the tumor has given her a great deal of pain. Clinical examination showed a very stout woman with a tumor in the subcutaneous tissue of the left axilla on the wall of the thorax. It was somewhat movable of the size of a plum lobulated soft but with a number of hard nodules in it. No glands could be felt. Extirpation was advised and done the next day. The operation showed a growth the size of a plum near the edge of the pectoralis major below the subcutaneous tissue partly well defined from the surrounding enormously thick layer of fat partly extending to the fascia of the brachial vessels and nerves. The whole axilla under the pectoral muscles—the supraclavicular space—is filled with small hard lymph glands. The microscopic examination showed a typical adenocarcinoma the tumor to my mind being an aberrant mammary gland with carcinomatous degeneration. Clinically an aberrant mamma and a lipoma can easily be mistaken but because of the location in the axilla the possibility of an aberrant mamma should be considered.



## CURIOUS CASE OF GASTRIC ULCER CAUSED BY SHELL FRAGMENT

By I. H. VANDER  
A. J. L. S. G. F. H. M.

**C**OPPOKAI J. wounded at Verdun April 3, 1916 by several splinters of shell arrived at the American Ambulance with the diagnosis of superficial wound of the right thigh left leg forehead and scalp. The wound of the thigh was the largest and involved the external muscle. Many splinters were removed and the patient was completely healed. The wound 45 days after his arrival at the hospital. Just as he was about to be discharged he complained of abdominal pain and noted he had the sensation of a foreign body in his abdomen.

tum and proceeded to close the wound operation the usual way.

## CONCLUSIONS

Every war surgeon has found splinter in extraordinary places and if I may say so these splinters seem to have reached their destination in inexplicable ways.

I am not going to try to explain in this case how the splinter of shell reached the lesser peritoneal cavity how it managed to cause the ulcer without perforating the peritoneal membrane how it occasioned a hemorrhage after 46 days how it was sterile and how the patient was so fortunate. I only wish to call the attention of war surgeons to the possibility of a soldier having a splinter in his abdomen without any appreciable trace of a skin wound. Probably because the wound was so very small and the patient had many wounds the surgeon at the front did not make note of it especially as the final symptom appeared late.

A second point less interesting is that the X-ray plate and fluoroscopic examination do not always show the presence of foreign bodies. In this case the splinter was concealed by the shadow of the vertebral column.

A third point is the great responsibility that rests with the war surgeon when he makes a diagnosis of malingering. In the above case had the patient been discharged he would have run all the risks of perforated gastric ulcer. A curious thing in connection with this case is the absence of any objective symptoms apart from the pain and later the hemorrhage. The patient could eat and drink anything. When he was able to get up he went out every other day and sometimes came back intoxicated. All these reasons led me to believe that it was a case of simulation.

On July 11, 1916, the patient was admitted to the hospital. The wound of the thigh was the largest and involved the external muscle. Many splinters were removed and the patient was completely healed. The wound 45 days after his arrival at the hospital. Just as he was about to be discharged he complained of abdominal pain and noted he had the sensation of a foreign body in his abdomen.

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## TRANSFUSION OF BLOOD IN SEPTICÆMIA OF LONG DURATION

B. C. MONCANY, M.D.

F. I. P. H. p. l. A. d. M. J. F. i. C. I. F. h. a. m.

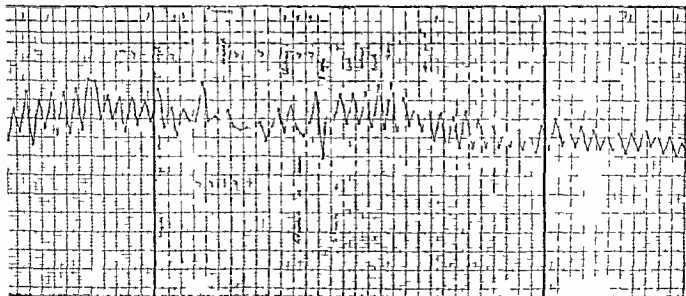
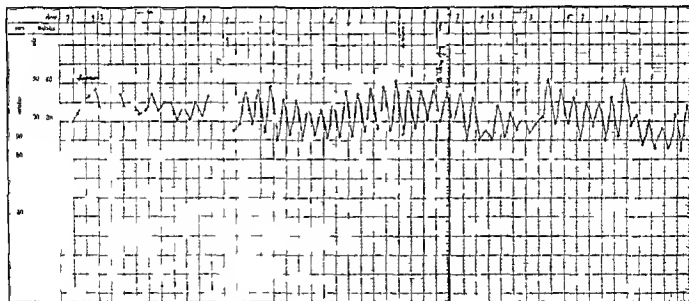
A SOLDIER wounded October 26 1916 in the right elbow and right knee by splinters of shell developed septic arthritis of both joints. On November 3 I operated doing a resection of the elbow and arthrotomy of the knee joint.

On December 2 there was a secondary hemorrhage from the popliteal vein and as I noticed distant abscesses of the leg and also a very bad osteitis I amputated the limb.

The pus from the wound was frequently examined

and during the first fourteen days streptococci were found. Notwithstanding that the streptococci were no longer found in the pus after that time the general condition of the patient was very poor the temperature was high with big oscillations and the blood culture showed the presence of the microbe.

From December 25 to February 13 I treated the septicæmia by intravenous injections of electrogol (10 cubic centimeters each) and by subcutaneous injections of Leclainche Vallee polyvalent serum (30 cubic centimeters each). In all eighteen injections of the former and ten of the latter were given.



The blood count showed the number of red corpuscles to be 3,220,000 and the white 6,400.

This extreme anemia prompted me to inject human blood which I did every second day in dose of 50 cubic centimeter each mixed with Locke's solution.

Three days after the last injection a fixation abscess formed where one of the subcutaneous injections of Leclainche's serum had been given.

As soon as the abscess was opened the temperature gradually fell to normal and the general condition improved a good deal. The blood culture was negative and the blood count showed an increase of red and white corpuscles.

The patient made satisfactory progress.

In cases of this kind injections of human blood probably act as a hæmatopoietic stimulant.

## UNUSUAL PROPAGATION OF A VASCULAR BRUIT

By C. MONCAY, M.D.

E. P. HOWLAND, M.D., F.A.C.S., F.A.M.A.

On October 20, 1916 my attention was called to Sergeant H. who complained of fatigue and breathlessness after exercise of a certain duration, sensation of giddiness and pain at the base of the thorax which he compared to the uncomfortable feeling caused by wearing a tight belt.

This patient admitted to the hospital September 10, 1916 to have a splinter of shell removed from the right scapula near the axilla. When mining by excavation I found in the middle of the lumbar region a systolic bruit which might be compared to the sound of escaping steam. In seeking the method of transmission of the bruit and its limit I arrived at the fact that it was motile in the

region of the coccyx. I called the attention of Dr. Hille, Chief of the Medical Section to this peculiar bruit. He was skeptical at first until he had examined the patient. Following the vertebral column the bruit could be heard from the fourth cervical vertebra to the end of the coccyx. It could also be heard in all the abdominal region, in the inguinal region and as far as the lower part of the gluteal muscle the bruit became more pronounced at the site of the umbilicus.

The patient had been wounded nineteen months previously on the fourth of March, 1915 by a steel splinter six feet in length. He was knocked down by the explosion and had a serious abdominal contusion especially in the right side. He stayed in bed for 5 days. Later apparently cured of his wound he returned to duty on October 3, 1915. Sometime later he was in the depot and for the first time at the front. He complained often of abdominal pain and a feeling of giddiness but we found no indication of any wound either in the abdomen or the lumbar region.

One morning the patient was examined while sitting and by abdominal palpation I found in the right side of the umbilicus a systolic pulsating movement and at times a thrill. I could also see the abdominal wall pulsating. In both femoral arteries the pulsation at the same distance was an indication of any new or doubtful diagnosis of arteriovenous aneurysm was established but the cause remained unknown.

An instantaneous X-ray plate was taken and we could see a thin splinter of bone in the front part of the right sacroiliac joint. This splinter had not been visible on any other X-ray plate because it was mobile and too thin.

Because of the presence of the splinter and all the other symptoms we felt justified in making a diagnosis of arteriovenous aneurysm of the right primitive iliac artery, the aneurysm producing the systolic bruit which could be detected over a very wide surface and in unusual places.

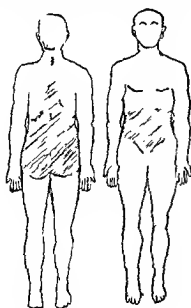


Diagram showing location of splinter

# DEPARTMENT OF TECHNIQUE

## AN OPERATION FOR THE RELIEF OF PYLORIC OBSTRUCTION IN INFANTS

By RALPH C. CUPPER, M.D., F.A.C.S., CHICAGO  
P. 105, I. C. 15, G. 2, Ch. 2, U. 1, M. 1, d. 5, G. 2

THE stomach is emptied. Ether is administered. The usual upper right rectus muscle splitting incision is made. The tumor is delivered and held firmly between the thumb and index finger. A longitudinal incision to 3 centimeters in length is made through the serosa and circular muscle fibers down to the thickened mucosa. After the muscle is divided, a definite line of cleavage between muscle and mucosa is seen. The incision is spread apart with blunt forceps. When the muscle is sufficiently liberated, the mucous membrane will protrude freely into the wound. There is very little hemorrhage; occasionally a small vessel will require a ligature. Usually the application of a warm pad to the wound edges will control the oozing. In spreading the incision, it is best to start at the stomach end of the incision as here the merging of the stomach wall into the pyloric tumor is a gradual process and there is little danger of opening the mucosa, whereas the change from the

thick and oedematous pylorus to normal duodenum is so sudden that care is necessary to avoid opening the intestine at this point.

The serosa is freed from the muscle for a distance that will allow coaptation of the edges without tension and permits the muscle to remain in the separated position. The serosa is approximated by the application of two or three coaptation sutures. This operation differs from the Rammstedt procedure only inasmuch as serosa is made to cover the mucosa. There are a sufficient number of reports of successful Rammstedt operations on record to preclude the fear of leakage and peritonitis. Still in view of the fact that serosa can be successfully placed over the mucous membrane without materially shortening the operative time, I believe it worthy of trial; it gives one more line of defense and leaves a closed wound rather than an open one.

The abdomen should be closed in layers with out drainage; the skin closed with linen and the



Fig. 1 Modified Rammstedt operation

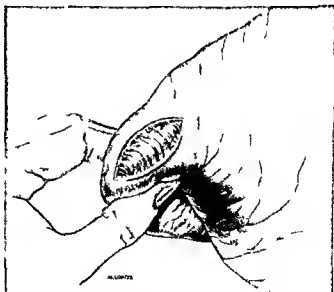


Fig. 2 Complete Rammstedt operation

abdomen retractor by the application of a wide circular adhesive band. Separation of the abdominal incision has occurred. This complication is not unlikely when we consider the crying and necessary handling of the patient.

The postoperative course consisted of early feeding to 3 drams of diluted milk 4 to 5 hours after the operation to once every 4 hours on the third day. Overfeeding to be discouraged for oedema at the operative site may occur in the symptoms return. Withdrawal of feed and gastric lavage will usually correct this condition. Hypodermoclysis is frequently required.

I applied this operative procedure in an infant in May 1916 and in another in October 1916.

Both had a normal postoperative recovery and have developed and progressed perfectly.

After consulting the writings of Downe I was impressed with the postmortem finding of an infant dying of endocarditis 3 months after a successful Pammstedt operation. In this case the stomach removed showed an elliptical cicatrix on the anterior surface of the pylorus about one half the size of the original wound. The area was covered with serosa and appeared to consist of crota and mucosa only.

Experience and time may bring out objections to the Pammstedt type of operation but until something better is established this should be the operation of election.

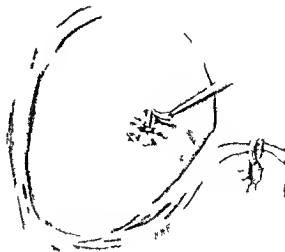
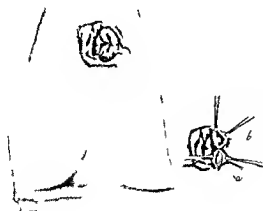
## THE RADICAL CURE OF HEMORRHOIDS

B. CHAFFIN J. DRUCK, M.D.

THOUGH it is true in the back realm of surgery which affords the patient such prompt positive and complete relief as well performed removal of hemorrhoids it is one of our most satisfactory surgical procedures.

Once the tumor has formed subsequent inflammation will produce a hypertrophy of the connective tissue about the vein and therefore no possibility of the tumor being absorbed.

There are some cases of hemorrhoids which had better be operated upon under a general anæsthetic when the surgical condition need attention. However almost all hemorrhoids may be satisfactorily operated upon under a local anæsthetic. When



operated upon under a local anæsthetic the patient need be away from business but a few days and the complications endangering the life of the patient which may follow the use of a general anæsthetic the pain and the danger of secondary hemorrhage due to vomiting are eliminated. A local anæsthetic has a distinct advantage in aged, timid or nervous patients.

*Preparation.* The patient is as carefully and thoroughly prepared for a hæmorrhoid operation as for a laparotomy. If a cathartic is deemed necessary an ounce of castor oil is given 24 hours before the operation to carry away septic and decomposing material from the intestine. The cathartic must be given far enough in advance of the operation to allow the patient to rid himself of it and for the peristalsis to subside. If the patient has been using a cathartic daily the oil may sometimes be profitably omitted and thus guard against exhausting the patient. Most patients do not eat much previous to the operation but some think it a last chance for several days and unless warned will overeat. I ask the patient to abstain from meat, vegetables with much cellulose and gas forming foods and to subsist on broths, cooked pulpy vegetables and other absorbable foods for the day before the operation. The patient enters the hospital the evening before the operation and if restless is given 20 grains of bromides to insure sleep. He is given a normal salt enema that evening and then left undisturbed. Early on the morning of the operation the perianal region is shaved and cleansed and a sterile dressing applied. Three hours before the operation the patient is given a one pint enema. One hour before the operation he is given a cup of soup or coffee and toast as it is better not to operate on an empty stomach. He is given a hypodermic injection containing morphine  $\frac{1}{4}$  grain, hyoscine  $\frac{1}{100}$  grain and atropine  $\frac{1}{150}$  grain and visitors are requested to leave him. The hypodermic quiets him and does away with the psychic trauma.

*Operation.* My operative technique is the same under local or general anæsthetic. The position of the patient may be suited to the individual case. The left lateral prone position with the hips raised (the proctologic position) is satisfactory for the surgeon as well as the most comfortable for the patient and prevents the sacro iliac strain which so often is caused by the lithotomy position. However some patients breathe more easily in the exaggerated lithotomy position.

When the hæmorrhoid is brought well into view it is picked up at its upper end with a

hæmorrhoidal forceps and an incision beginning in the normal mucous membrane one quarter of an inch above the hæmorrhoid is carried down on the left side of the pile and beginning again at this upper point a similar incision is carried down on the right side of the tumor. The upper pole of the tumor is now lifted out of its base exposing the vessels as they enter the tumor from above. The vessels are grasped with a thin artery forcep and the tumor cut free. The lateral incisions are carried down to and around the lower border of the hæmorrhoid. These lateral incisions are to be kept close to the hæmorrhoid or preferably in that part of the mucosa covering the side walls of the pile. The dissection is carried down around and beneath the hæmorrhoid to solid connective tissue or fascia about the muscle coat of the bowel and the pile is shelled out by blunt dissection (Fig. 1). This nucleation of the tumor is almost a bloodless operation. The pedicle in the grasp of the forcep at the upper end of the wound next receives our attention. The size of this pedicle will vary with the size of the hæmorrhoid but even when the tumor is large and fleshy the pedicle is slender because it consists only of blood vessels and the connective tissue supporting structures between them. The pedicle is now lifted well up and examined to make sure that it is thoroughly freed from the mucous membrane and a No. 1 catgut ligature is slowly but firmly tied close down at the base. One end of the ligature now threaded on a curved non cutting needle is passed through the base of the stump beneath the ligature. The forceps and upper part of the stump are now cut free about one eighth of an inch above the ligature and the thread that transfixes the stump is tied over the stump and across the encircling ligature thus preventing it from slipping. As the stump is released it retracts well into the bottom of the wound and the mucous membrane edges fall together over it. It is important to tie the stump carefully as it is small and if not properly secured secondary hæmorrhage might result. The wound edges fall together in good apposition but should be secured by two small interrupted sutures. If the tumor is in the anal canal its lower edge may rest at the white line where the skin and mucous membrane meet. If the tumor is of the interno external variety it is to be removed *in toto* by continuing the dissection over the white line out onto the skin taking out a V shaped piece of skin and inflammatory tissue sufficient to restore the anus to a normal appearance (Fig. 2) and the wound is closed with a

few interrupted catgut sutures. When dissecting out the hemorrhoid care should be taken to leave a clean cut smooth surfaced wound. A ragged wound is more liable to bleed because it interferes with the normal muscular contraction of the tissues.

Whether the operation is performed under local or general anæsthetic care should be exercised to handle the parts gently for unnecessary dilatation of the sphincters as well as rapid or rough manipulations and catching with nap forceps the tissues which are not to be removed all cause more subsequent pain and increase the danger of infection. It is important that skin tabs be removed at the time of the operation otherwise they engorge and inflame and become most painful.

The operation completed and the field cleansed the rectum and anus are well covered with sterile vaseline carefully and freely covering each and every wound. A light gauze dressing is then applied and held with adhesive straps. I do not use a tube within the rectum because I am convinced that it does not serve any good purpose and it certainly causes the patient intense pain and is one of the active factors tending to cause retention of urine.

When the patient is put to bed he is kept in the Sims position or else prone (on his face). Do not allow him to lie on his back because in this position the middle and superior hemorrhoidal vessels in their upper portion are in a vertical position. At the pelvic brim they bend at a sharp angle and the abdominal contents are superimposed. All of these obstruct and the hemorrhoidal vessels have no valves there is a back pressure and a tendency to swelling giving away of the stitches and more pain as well as a delay in repair. After the first day in bed our patient may turn about and assume any comfortable position.

*After treatment.* The after treatment of hemorrhoid patients is very exact but unfortunately is often neglected with the result that complications frequently occur. Although general standards of postoperative care can be given there is much individuality in each case and it is very important that the physician look after his patients himself in so far as possible for a little slip in the after treatment might spoil the effect of a very good operation.

The degree of pain following any operation depends somewhat on the temperament of the patient but also to a large degree on the technique and skill of the operator. During the first day I use hot compresses. No opiate is

needed ordinarily but there is no harm whatever in the administration of a sufficient amount of morphia hypodermically to prevent even pain following operation. It is better to give a sufficient amount of morphia to give complete relief at once rather than to give repeated doses. For patients of average weight and strength  $\frac{1}{4}$  grain morphia and  $\frac{1}{100}$  grain atropine. In case that does not give relief the dose may be repeated in one half to one hour.

The accumulation of flatus in the bowel frequently in annoyance. If it occurs urge the patient to void it. If left to himself he usually restrains the desire because he is afraid bleeding may occur and he will often spend a wakeful restless night when he could have relieved himself without any possible harm.

Retention of urine is always a concern to the surgeon but when operating under local anæsthesia little difficulty is experienced if the patient has been properly prepared and is not too soon disturbed after the operation. Never suggest the subject nor try to have him void his urine within the first twelve hours postoperative. It is an effort for a healthy man to empty a partially filled bladder and if you wait twelve hours until the patient's bladder is filled he will urinate voluntarily especially if he is allowed to slip out of bed and use a commode or urinate while standing.

The postoperative diet for the first day consists of liquids given every two hours: soup, broth, egg albumin, buttermilk and cream four ounces with water two ounces. No milk is allowed. On the second day semi solids: poached egg, toast, custard, rice, sago, absorbable vegetable and cooked apple, prunes or other fruit for beverage: tea, coffee, grape juice, lemonade and orangeade. After this a regulated general diet is allowed.

The patients expect defæcation to cause terrible pain and I presume their fear acts as an inhibition to evacuation. At the end of the second day I inject six ounces of mineral oil into the rectum through a soft catheter and have the patient use a commode instead of a bed pan. Each day thereafter he is given an enema of eight ounces of normal solution or of glycerine two ounces and water six ounces. Wet cotton is used as a detergent after each bowel movement. When the patient leaves the hospital his hemorrhoids are cured but there is still in many cases the effect of long continued disturbed digestion and the patient should be impressed with the importance of after treatment and given direct or through his home physician

such directions regarding diet and medication as may be necessary

I never use bichloride of mercury during the operation nor in any of the after dressings because it sets up a teasing tenesmus as soon as the sensory nerves recover

The advantages of this technique are

1 The operation is thorough and may be satisfactorily performed under local or general anæsthesia. The incised wounds carefully coapted heal more readily than crushed or cauterized surfaces

2 The sphincter muscles are not disturbed or injured by forcible dilatation as a speculum is not used

3 The ligature is so applied as to securely hold the vessels and secondary hæmorrhage cannot occur nor is there any sloughing tissue separating several days later

4 The stump is small and buried and the wound edges are closely approximated so that the resulting scar is smooth and level with the

surrounding mucosa instead of being raised. Therefore it does not obstruct the passage of the fæces. It is this raised hard scar left after operation for the removal of hæmorrhoids which more than any other one factor tends to induce a recurrence of the trouble

5 All of the diseased tissue is removed therefore recurrence is impossible but enough of the mucosa is left to maintain in good order the tactile sensibility of the anus. This is one of the points of superiority over a clamp and cautery method of operation which must necessarily grasp much tissue outside of the hæmorrhoid or else leave part of the varix behind. If a portion of the varicose vein remains infection and abscess is prone to occur

6 The scar of the wound conforms to the axis of the anal canal and cannot narrow the lumen of the bowel

7 The postoperative analgesia continues for several days and the patient is up and out in a few days

## ARTIFICIAL VAGINA UTILIZING A SINGLE PORTION OF ILEUM<sup>1</sup>

By A. W. ABBOTT, M.D., F.A.C.S., MINNEAPOLIS, MINNESOTA

INSTEAD of attempting to cover the entire subject of artificial vagina I will discuss only the advantage of using a single limb of an iliac loop in place of the entire loop. The moral side of the question will not be taken up. Suffice it to say that the psychic effect on the woman in

the writer's opinion is often a sufficient reason for the adoption of the operation. The marriage or not of the individual being of secondary importance

Since Baldwin in 1904 proposed to make a mucous lining for an artificial vagina by drawing

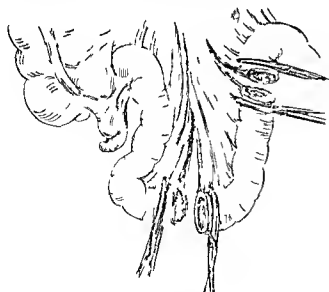


Fig 1

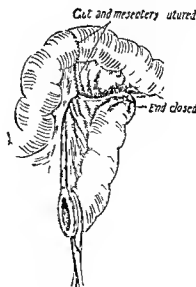
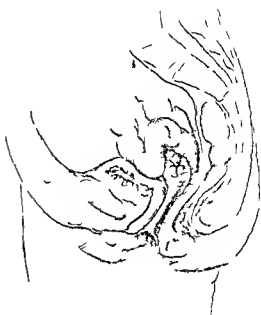


Fig 2





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down a lap of intestine and in 1910 reported a case of his in which the operation had been done successfully in 1911 up to 1915. The number of cases reported and unreported to date would probably reach 30 perhaps more. In all but one as far as known the technique suggested by Baldwin has been followed and the loop of the ileum has been utilized and the septum divided later when agglutination between the two limbs has become accomplished.

The one exception is a case reported by Wallace<sup>1</sup> in which he made use of the sigmoid in only one limb of the sigmoid loop.

As the ileum may be distended to the diameter of 1.5 inches without injury to its coat and on one side of the loop, just as long as the whole loop, the writer used a single limb of an iliac loop in the following case which was referred to me because the young lady had never menstruated.

Miss B. G. 6, f. esp. m. n. l. y. g. w. m. hood. The chest deep east, fully developed. She had pelvic tumor, enlarged uterus, and female characteristics. The chest deep east, fully developed. She had pelvic tumor, enlarged uterus, and female characteristics. The chest deep east, fully developed. She had pelvic tumor, enlarged uterus, and female characteristics.

In March 1917, I performed a right iliac loop resection. After finding the natural line of cleavage, the

loop was separated from the abdominal wall and the sigmoid was divided. The loop was then brought down and anastomosis was performed. The chest deep east, fully developed. She had pelvic tumor, enlarged uterus, and female characteristics. The chest deep east, fully developed. She had pelvic tumor, enlarged uterus, and female characteristics.

In making the new vaginal opening, one should be careful to seek the natural line of cleavage. The

loose connective tissue between the vagina and rectum. This line can best be found after the vertical incision and can then be followed by blunt dissection with certainty of not piercing the bladder or rectum and with almost entire freedom from hemorrhage. This line of cleavage in women without a vagina corresponds quite closely in direction with the direction of the vagina in normally developed women. It is perhaps slightly more horizontal. In a woman lying upon her back the vagina beyond the levator ani edge is much nearer the vertical than is generally illustrated in our textbooks. For this reason a long and full curved forceps should be used in drawing down the gut into the vaginal opening.

The advantages of using one limb of the intestinal loop instead of both are

- 1 It takes less of the bowel
- 2 It requires the closure of only one end of the utilized limb instead of both ends of the loop

3 A second operation to divide the septum is unnecessary. The operation is complete in one sitting.

The operation is not in itself difficult for one accustomed to abdominal surgery but requires great care and accuracy whether done by the one limb or full loop method.

So far as the writer can learn there have been no deaths from any of the Baldwin operations and the results have been functionally satisfactory.

As between the use of the ileum and sigmoid by either method there is little to choose except that the use of the ileum is easier and by some considered safer. The use of the entire loop of intestine is certainly unnecessary.

A concise and interesting article by Novak<sup>1</sup> of this year and closely related to the subject of this paper discusses the history etiology pathology etc of congenital absence of the uterus and vagina.

S. S. Gy. & Ob. 97 53

## AN IMPROVED MURPHY DRIP APPARATUS

BY H. DAWSON FURNISS, M.D., F.A.C.S., NEW YORK.

**O**WING to the difficulty in administering the Murphy drip satisfactorily I have been led to devise an apparatus in which it is necessary to observe only one factor to insure comfort to the patient and only one more for efficiency. In spite of the fact that Murphy emphasized that the comfort of the patient depended upon the prevention of too great hydrostatic pressure and cautioned against it nearly every one fails to carry out this idea correctly. The apparatus herewith described is designed to eliminate the above mentioned fault.

The apparatus consists of a glass tube *a* one and one half inches in diameter and six inches long. Both ends are closed with either a rubber stopper or a cork *b* and *c*. Through the upper stopper are passed two tubes the longer *d* being for the inflow and tapered at the lower end. The shorter *e* is an air vent to prevent siphonage when the lower tube *g* is filled.

The lower stopper *c* carries two tubes *f* and *g*. The longer tube *f* is funnel shaped at the upper end to catch the flow from tube *d*. To the lower end of tube *f* is attached the tubing leading to the rectum. The shorter tube *g* is for the overflow either from too fast feed or from fluid

expelled from the rectum. A tube attached to this tube *g* leads to a basin or pail.

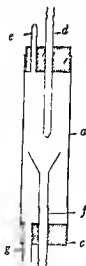
In use the apparatus is so placed (either suspended by the feed tube or held by clamps connected to the bed) that the top of the funnel is only 10 to 12 inches above the rectum.

No matter how fast the inflow the hydrostatic pressure cannot exceed 12 inches—for an excess would cause an overflow at the funnel. If it were not for tube *a* siphonage would take place when tube *g* became filled.

I am now using this apparatus on my service at the New York Post Graduate Hospital with great satisfaction.

The first apparatus was all glass and was abandoned in favor of the one with rubber or cork stoppers as the latter can be so much more easily cleaned.

To insure against the stoppers slipping an elastic band is placed between the tubes on the upper and the lower stoppers.



# CORRESPONDENCE

## REPORTING OF ACCIDENTS FROM LOCAL ANÆSTHETICS

To the Editor: The Committee on Therapeutic Research of the Council on Pharmacy and Chemistry of the American Medical Association has undertaken a study of the accidents following the clinical use of local anesthetics especially those following ordinary therapeutic dose. It is hoped that this study may lead to a better understanding of the cause of such accident and consequently to method of avoiding them or at least of treating them successfully when they occur.

It is becoming apparent that several of the local anæsthetic if not all of them in general use are prone to cause death or symptoms of severe poisoning in a small percentage of the cases in which the dose has been hitherto considered quite safe.

The infrequent occurrence of these accidents and their production by relatively small dose point to a peculiar hypersensitivity on the part of the individual in whom the accident occurs. The data necessary for a study of the accidents are at present wholly insufficient especially since the symptoms described in most of the cases are quite different from the commonly observed in animals even after the administration of toxic but not fatal doses.

Such accidents are seldom reported in detail in the medical literature partly because physician and dentists fear that they may be held to blame should they report them partly perhaps because they have failed to appreciate the importance of the matter from the standpoint of the protection of the public.

It is evident that a broader view should prevail and that physician should be informed regarding the conditions under which such accidents occur in order that they may be avoided. It is also evident that the best protection against such unjust accusations and the best means of preventing such accidents consists in the publication of careful detailed records of the cases in which the accidents have occurred with the attending circumstances.

The case should be reported in the medical or dental journal when possible but when for any rea-

son this seems undesirable a confidential report may be filed with Dr. R. A. Hatcher 414 East Twenty Sixth Street New York City who has been appointed by the Committee to collect this information.

If desired such reports will be considered strictly confidential so far as the name of the patient and that of the medical attendant are concerned and such information will be used solely as a means of studying the problem of toxicity of this class of agents unless permission is given to use the name.

All available facts both public and private should be included in these reports but the following data are especially to be desired in those cases in which more detailed reports cannot be made.

The age, sex and general history of the patient should be given in as great detail as possible. The state of the nervous system appears to be of especial importance. The dose employed should be stated as accurately as possible also the concentration of the solution employed the site of the injection (whether intramuscular, perineural or strictly subcutaneous) and whether applied to the mouth, nose or other part of the body. The possibility of an injection having been made into a small vein during intramuscular injection or into the gums should be considered. In such cases the action begins almost at once that is within a few seconds.

The previous condition of the heart and respiration should be reported if possible and of course the effects of the drug on the heart and respiration as well as the duration of the symptoms should be recorded. If antidotes are employed their nature and dosage should be stated together with the character and time of appearance of the effects induced by the antidotes. It is important to state whether antidotes were administered orally or by subcutaneous intramuscular or intravenous injection. The concentration in which such antidotes were used should also be stated.

While such detailed information together with any other available data is desirable it is not

to be understood that the inability to supply such details should prevent the publication of reports of poisoning however meager the data so long as accuracy is observed

The committee urges on all anæsthetists surgeons physicians and dentists the making of such reports as a public duty it asks that they

read this appeal with especial attention of the character of observations desired

TORALD SOLLMANN *Chairman*

R A HATCHER *Special Referee*

Therapeutic Research Committee of the Council on Pharmacy and Chemistry of the American Medical Association

## PROCAINE AND NOVOCAINE IDENTICAL

*To the Editor* It appears that in certain quarters the attitude is taken that the local anæsthetic sold as procaine is not identical with that marketed as novocaine. The Subcommittee on Synthetic Drugs of the National Research Council believes it important that this misunderstanding should be corrected and hence offers the following explanation

The monohydrochloride of para amino benzoyl diethyl amino ethanol which was formerly made in Germany by the Farbwerke vorm Meister Lucius and Bruning Hoechst A M and sold under the trademarked name novocaine is now manufactured in the United States. Under the provisions of the Trading with the Enemy Act the Federal Trade Commission has taken over the patent that gave monopoly for the manufacture and sale of the local anæsthetic to the German corporation and has issued licenses to American concerns for the manufacture of the product. This license makes it a condition that the product first introduced under the proprietary name novocaine shall be called procaine and that it shall in every way be the same as the article formerly obtained from Germany. To insure this identity with the German novocaine the Federal Trade Commission has submitted the product of each firm licensed to the A M A Chemical Laboratory to establish its chemical identity and purity and to the Cornell pharmacologist Dr R A Hatcher to determine that it was not unduly toxic

So far the following firms have been licensed to manufacture and sell procaine

The Abbott Laboratories Ravenswood Chicago  
 Farbwerke Hoechst Company New York N Y  
 Rector Chemical Co Inc New York N Y  
 Calco Chemical Company Bound Brook N J

Of these the first three firms are offering their products for sale at this time and have secured their admission to *New and Nonofficial Remedies* as brands of procaine which comply with the *New and Nonofficial Remedies* standards

While all firms are required to sell their product under the official name procaine the Farbwerke Hoechst Company is permitted to use the trade designation novocaine in addition since it holds the right to this designation by virtue of trademark registration

In conclusion procaine is identical with the substance first introduced as novocaine. In the interest of rational nomenclature the first term should be used in prescriptions and scientific contributions. If it is deemed necessary to designate the product of a particular firm this may be done by writing procaine Abbott procaine Rector or procaine Farbwerke or procaine (novocaine brand)

JULIUS STIEGLITZ *Chairman*  
 Subcommittee on Synthetic Drugs  
 National Research Council

Washington D C

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

MEETING HELD JANUARY 18 1918 DR N SPROAT HEANEY PRESIDENT IN THE CHAIR

### COINCIDENT INTRA UTERINE AND RUPTURED TUBAL PREGNANCY

DR ARTHUR H CURTIS The specimen was removed two weeks ago tonight from a patient 33 years of age. Her previous health has been good. Two daughters were born respectively 5 and 7 years ago. Both labors were uneventful. The younger daughter a victim of aplastic anemia twice transfused by me died three years ago. The patient's menstruation is of the 28 day type regular and normal in amount. The last period which was normal began October 30 slightly more than two months previous to operation. Associated with the amenorrhea were the usual symptoms of pregnancy.

In the early morning just two weeks ago there occurred sudden gonalgia in the right pelvic pain followed by extreme pallor and the rapid pulse. There was no other loss of consciousness nor bloody discharge from the vagina. Under morphine the condition had noticeably improved when first seen by me twelve hours later.

Examination revealed a tympanitic abdomen containing boggy mass rising out of the right iliac fossa to a level halfway up the abdomen. The symphyseal space was normal.

At operation immediately thereafter were found about two litres of free blood in the peritoneal cavity. The left tube was bleeding profusely from rupture of a pregnancy in the isthmic portion. The tube was ruptured so completely that only a small bridge of its wall remained.

The uterus for shrinkage in Kaiser's solution as you now call it three times its normal size and contained more than a dozen fibroids. The intrauterine pregnancy of over 6 months development was smaller than the uterine cavity was easy to drag out at the time of operation.

Only one corpus luteum was found. This was in the right ovary on the side opposite the tube which contained the pregnancy.

It was thought best to perform a supravaginal hysterectomy together with removal of the left tube and ovary. The patient has almost completely recovered from the operation.

### COINCIDENT CARCINOMA OF THE CERVIX AND PREGNANCY

This specimen was removed 6 days ago from a patient 26 years of age. She had always been well

until the present trouble began. The patient began to bleed two months ago after a history of regular normal menstruation. Since that time daily oozing has occurred.

Examination shows an extensive squamous cell carcinoma of the cervix chiefly in the posterior lip. In the uterus is a fetus approximately three months of age.

### DISCUSSION

DR CHARLES E PADDOCK I am not familiar with the statistics regarding the relative frequency of gestation in the tube and the uterus at the same time. I had thought that such a condition was not of such rare occurrence that Dr Curtis should have seen but one in an extensive gynecological service. How much the uterus grows in the first few months of an ectopic gestation probably varies but that it does increase its size up to the third month has been my opinion. If this be so I wonder then how the doctor knew that there was an intrauterine pregnancy until he had opened the uterus. I am sure that he acted wisely in removing that organ.

DR C HENRY DAVIS As I understand the carcinoma of the cervix in this case was not of long standing.

DR CURTIS You must remember that the specimen on account of being in Kaiser's solution have shrunk very materially. The carcinoma of the cervix is much larger than it looks to be. It was of many months duration although the history dates back only three months. The growth was enormous when it was taken out and it was fairly ill defined.

DR DAVIS Did you leave the tube and ovaries?

DR CURTIS You see the whole specimen. The ovaries were left.

DR CHARLES B REED I would like to ask Dr Curtis if he has had any experience with the use of radium on the fetus in such cases?

DR CURTIS I have not had experience with the use of radium in its effects on the fetus. If the action of radium is selective as I understand it the more highly differentiated and specialized the cell the greater the likelihood that they will be destroyed. In view of the fact that radium has a marked action on the ovaries I suppose there could be abortion of the fetus due to the action on the corpus luteum if the radium be given for a considerable time.

I am very sorry Dr Paddock did not see this case. Dr Gibson and three or four other men were present at the time the uterus of this woman appeared of enormous size and very soft not only to me who felt of the uterus but to those who were standing nearby. We thought there was intra uterine pregnancy. We did not open the uterus until two or three days later.

DR N SPROAT HEANEY Dr Curtis's cases bring up two particular points which we as teachers should emphasize to our students. The first point is in regard to the size of the uterus in ectopic pregnancy. From the reading of their textbooks the students believe that the uterus is constantly enlarged in ectopic pregnancy. Most cases that come to operation come before the tenth week and it is rare for the uterus to be enlarged appreciably in the greatest number of cases that come to operation. It is only in advanced ectopic that the uterus is appreciably enlarged.

The second case shows that a very young woman may have a carcinoma of the cervix. Students gain an impression in the medical schools that there is a particular age applicable to cancer cases called the cancer age. This belief is so ingrained that it comes into consideration especially in differential diagnosis. A patient may have carcinoma at any age and it is distinctly bad teaching to take the age of the patient into consideration when arriving at a diagnosis.

As to the question of the frequency of extra uterine and intra uterine pregnancy while I have never had a case of my own I know from a recent examination of the literature that they are not very common.

DR JOSEPH L BAER I would like to ask Dr Curtis whether there were any bladder symptoms in the intra uterine and extra uterine case or bladder symptoms such as we find in cases of simple intra uterine pregnancy.

With reference to the effect of radium on existing pregnancy I know of one case of carcinoma of the vulva a patient of Dr Frankenthal's that was subjected to radiotherapy after a radical extirpation during pregnancy and she miscarried at seven months.

DR CURTIS So far as I know there were no bladder symptoms accompanying the pregnancy. The history we obtained was very meager. I did not go into the details as usual because the patient was very sick.

#### VICARIOUS MENSTRUATION

DR EMIL RIES About two months ago Dr Baer reported a case of vicarious menstruation and at that time I expressed my disbelief in the existence of such a condition. In the meantime a case came to my knowledge which proves again the weakness of the ordinary description of vicarious menstruation. I had performed hysterectomy on a patient and six months afterward she came to the hospital and informed me that she had nose bleed every month.

Now when you come to nail these patients down to the exact data you meet with disappointment. This patient could not give exact data as to periodicity or duration. However I sent her to the nose clinic. She was examined there and found to have two ulcerated areas on the septum of the nose. These were cauterized and she has had no vicarious menstruation since.

DR JOSEPH L BAER I have been awaiting an opportunity to make a final report on my case. The patient was sent to the hospital to determine definitely regarding her case as she claimed she had suffered from dried sweat from the axillae during the two years of married life. She had never menstruated. Bi manual examination disclosed a short vagina with no cervix and a very rudimentary uterus resting some 4 or 5 centimeters above the termination of the vagina. As I have said this patient was taken to the hospital the axillae shaved and strapped with sterile pads of gauze and cotton and locked as securely as possible with adhesive in all directions to prevent the addition of red ink or any other substance on her part. She was kept under observation. We made her exercise in order to perspire and gave no medication. For a few days the pads showed a distinct reddish pink discoloration. These pads were sent to the laboratory as were the original washings and the final report of the laboratory was that there was no blood elements present either in the form of blood cells or hæmatin as shown by the spectroscope or by any other method they had at their disposal. The pathologists suggested that it was probably a fungous growth but they could not demonstrate the fungus either by cultural or slide methods.

DR WILLIAM C DANFORTH I saw a case some seven or eight years ago in a family I was taking care of at that time. The patient was a woman a little over fifty who had vomiting of blood with typical black tarry stools. We made a diagnosis of gastric ulcer and treated her accordingly. She wanted to have an internist see her. He saw her and made a diagnosis of vicarious menstruation from the stomach. This seemed to me to be a very far fetched diagnosis.

DR CHARLES B REED The instances are some what hazy in my mind but in this connection it may not be uninteresting to recall that there are definite reports of the shroud in which our Lord was enclosed when he was removed from the cross. It is supposed to be in a cathedral at Vienna and on certain occasions it is said to turn red and thereby apparently gives evidence of the blood which the Lord passed at the time of his crucifixion. This redness has been analyzed and found to consist of certain bacilli (bacillus prodigiosus) which simulate the appearance of blood. Arctic explorers report that the snow at times seems to be covered with blood and this too has been determined to be of bacillary or infusorial origin. It is intelligible to me therefore that Dr Baer's case might be similar to these other instances of which we have knowledge.

## INDUCTION OF LABOR AT TERM

DR CHARLES B REED read a paper entitled  
Induction of Labor at Term (See p 163)

## DISCUSSION

DR CHARLES S BACON It is interesting to observe the positive results which the author has stated his case and described his method indicated that I should be as positive about many of the procedures in obstetrics as he is about this. It could be very convincing to me if it were not for my own experience which does not coincide with that of Dr Reed. I have induced labor in a good many cases but very rarely endeavored to shorten the term of pregnancy almost always for toxemia or where there were some other pathologic conditions and in a few cases but not so much in recent times.

Here there was a contract of pelvis. But in all of these cases I have been under the constant fear of infection and that fear was due to the fact that I have had infection in many cases. In only two or three instances was the infection serious but the case was enough of a disturbance to make me feel uneasy and I do not think that infection was due to any fault in the technique or that it can be avoided by the adoption of any particular technique. The cause I do not believe that it is possible to adopt a technique that cleans the vagina and renders it sterile. But I realize that the labor is induced by a slower method than that of chorion suction and infection is greater. It has rarely happened that labor is terminated in a primipara in less than 4 hours and frequently the labor lasts considerably longer. In multipara the duration of the labor is nearly twice as long as in the case reported by Dr Reed. This may account possibly for the increase in infection but the probability of the labor is due to the method of extra traction which perhaps is rather questionable.

In normal cases 6 per cent for episiotomies could be considered very large indeed. When in a clinic the frequency of forceps operations is 9 or 10 per cent generally assumed to be due to the fact that the forceps are used for purposes of lemonstration and in the great clinics we expect not more than from 2 to 4.5 per cent for perineal lacerations. I am inclined to think from the simple fact that forceps deliveries occur in 16 per cent of the cases that there is actually more interference of that kind than is necessary and the use of pituitrin in a large number of cases (45 per cent) strikes me also as pretty large. Nevertheless if those methods of hastening labor can be adopted without injury and so avoid infection on they may be justifiable.

DR C HENRY DAVIS Dr Reed's work is very interesting and instructive. All of us who use bags have some little difficulties to contend with from time to time and because of those difficulties we rather hesitate to induce labor with a bag except for particular indications.

In Dr Reed's paper of two years ago he spoke of

putting obstetrics upon the same basis as other surgical procedures in that we could arrange the time for the patient to go to the hospital so that we would know practically when we are going to deliver her. That would be very desirable if we could work it out so that it would be safer for the mother and for the baby as a general proposition but in my rather limited experience in the use of bags I have had one patient who kept a bag for 24 hours had pains and failed to get any dilatation of the cervix. The bag was removed and three days later she went into labor and in the matter of a few hours was delivered spontaneously.

Another patient who was considered passed term had a bag introduced and was kept in for a considerable period of time before she expelled it and then labor pains stopped. Pituitrin was used. One cubic centimeter of pituitrin could cause contraction of the uterus and it would be followed by one or two weaker contractions when all pain stopped. She was given 3 cubic centimeters of pituitrin in the course of six hours without bringing along into active labor. Finally it was necessary to do a high forceps delivery.

Because of experiences like that I have felt that the bag should be reserved for cases where there is a definite indication for the termination of labor. I have never tested it out in cases of cases that were apparently normal. Perhaps that is the reason Dr Reed has had better results than the rest of us.

DR BACON I would like to ask Dr Reed in listening to state in what proportion of all of his cases he uses the induction of labor.

DR BACON I need scarcely express my admiration of Dr Reed's courage and enthusiasm in what he considers a pioneer field. The plausibility of it to me lies essentially in the very proper comparison that Dr Reed makes between the enlarged child and the unsized pelvis. In other words he has in very a relatively contraction. The fallacy of this reasoning however to me lies in the fact that we all resort to the induction of labor in those cases that appear to us to have small pelvises or in those cases in which there seems to be an unusually large head and yet the total number of cases in which one resorts to the operative interference is exceedingly small as compared to the total number of confinements that any one of us sees and analyzes.

Therefore I feel that in subjects of the vast majority of normal cases to the induction of labor at so-called term in order to evade the use of a large child's what I consider a very tangible risk to infection. Whoever has seen sepsis rise in an apparently normal healthy unmolested woman in a normal confinement and then has seen these cases terminate in death must recognize that there is another factor present than merely hardening of the pelvis or the cleanliness of the instrument that is the factor that lies within the woman herself.

DR N SPROAT HANEY Dr Reed's paper brings up two items for consideration one the orthness

of induction of labor at term and the other the relative innocuousness of the bag method of induction of labor. I think every obstetrician would agree that if labor could be induced without danger that it would be better to have the baby come when everything is ready than to have it come later and probably be associated with great delay and injury to the mother. From time to time I have induced labor in cases where I was absolutely certain that the patient was at term for no other reason than that the patient was at term with its attendant nervous phenomena by a method which I consider very efficient and without possibility of peculiar harm. When I have determined that the patient is due then I have the patient come to the hospital for an internal examination. If this examination substantiates my previous examinations I may separate the membranes from around the cervical canal and give the patient an ounce of castor oil and when the bowels begin to move I then give two or three doses of 3 grains of quinine at hourly intervals. This has produced labor in at least seven out of ten of all cases including those of premature labor. In urgent cases — urgent because of high blood pressure or other signs of severe intoxication — I use the bag only when the above means have failed. In other words I have given the bag only the hardest sort of cases to induce and consequently my results with the bag would not naturally be so smooth as were those of Dr. Reed. Three times this year I have had a cord prolapse after the bag has been expelled from the cervix and in two of these cases I have lost the baby. In the third because the child was very small and the patient a multipara I was able to deliver the child in time. In consequence I am very alert whenever I have to resort to the bag as a means of inducing labor and have associated it in my mind with considerable possibility of danger to the child and consequently have reserved it only for severe cases of intoxication where the child must receive secondary consideration. My experience has also been that the patient suffers ordinarily a great deal more in labor induced by a bag than when labor is more natural. I also have had bags fail to induce labor even though I can see no difference in my technique and that of Dr. Reed. I have removed bags that have been in for 24 hours where labor failed to occur and have had the patient go into labor spontaneously 24 to 48 hours subsequently to the removal of the bag.

DR. CHARLES E. PADDOCK. I am not convinced that the rubber bag as used by the essayist to start labor is practical in the hands of many of those who are doing obstetrical work. No doubt the essayist has developed a technique which enables him to insert the bag where others would fail at least my experience has not been that of the essayist and perhaps had I attempted the use of the bag often I would have become more proficient. The fact that a primipara is at term does not mean that the cervix is effaced or dilated for in how many cases do we find at the beginning of labor the cervix still

long and the os not admitting even a finger. Does it seem logical then that often an interne according to Dr. Reed can introduce into the cervix without an anesthetic a large Voorhees bag at 8 a.m. and have the labor terminate at 4 p.m. the same day in the majority of the cases? To me it would seem an impossibility had not the essayist brought forth such strong proof. Why such haste? Why is it necessary to set a time for the delivery of the woman? It certainly cannot be for the convenience of the physician because I firmly believe that such practice often complicates labor. Often there is a displacement of the presenting part and the bag frequently interferes with the mechanism of labor. Prolapse of the cord also results frequently. Therefore if the bag be inserted the case requires watchful care on the part of the physician and in the majority of the cases it delays labor.

The bag has its place but I am not ready to admit that because I think my patient has arrived at the end of her pregnancy a bag should be inserted to bring on labor. The essayist does not say that he uses other means of starting labor before inserting the bag. We are familiar with the quinine and castor oil treatment. Why not try that first? In at least 50 per cent of the cases such a treatment will bring on labor pains within 24 hours. We must not forget that most of the obstetrics are not done by the specialist and this paper when published will be read by a large class who are always looking for something new and sensational and coming from such a source it would be considered proper to insert a bag to bring on labor. I cannot agree with the essayist at all in this work.

DR. JOSEPH L. BAER. I would like to add three points to the great advantage of the castor oil and quinine method over the use of the bag. It is the routine for induction of labor at the Michael Reese Maternity. The first point I want to make is that in order to be efficient it should be preceded by separation of the membranes as Dr. Heaney has already explained. A single sweep of the finger inside the cervix does that. A second point is that there is a distinct difference between the susceptibility of primiparae and multiparae. The multiparae respond in almost 100 per cent of the cases. The primiparae respond in from 50 to 75 per cent. A third point is that in giving quinine we should watch the fetal heart tones. If you give a large dose say 10 grains once and choose to give 10 grains again an hour later you should check up on the heart tones first because we have had the experience that a second dose of quinine has resulted in irregularity of the fetal heart tones. We know that quinine exerts an influence on the musculature. The only criticism that can be offered against this method is the separation of the membranes intracervically, nevertheless that is so innocuous as compared with the prolonged stay of the bag that I feel it is well to emphasize the advantage of it.

DR. MARK S. GOLOSINE. After listening to the remarks of Dr. Paddock I must say in justice to



Dr. Reed that the internes on his service have introduced this bag in primiparae without an anæsthetic and that he did it right along. I talked to his last intern about it when I saw the title of his paper and he told me that he had introduced the bag in it as in a three months service and in none did he use an anæsthetic.

With reference to the question of castor oil and quinine in starting labor I often wonder that there is so much fuss about in starting labor. I do not believe I have given a dose of castor oil and quinine in my life for this purpose. I never saw a dose given in the Rotunda and in the last year I still have had 4000 odd as I did not have many patients that were not in term and I did not worry about them if they did not remember bringing an article by Dr. J. Whitely. Well as of late not about eight or nine years ago I have stated I had bad on a general term up to that time and that I was supposed to be 4 months and then I had a six pound baby. I do not think many hospitals use castor oil and quinine and so fussy when there are so few cases that go over term. I do not allow an obstetric patient to influence me as to the time of inducing labor.

Dr. Reed (losing) I am very much gratified at the discussion that my paper has brought out. I do not think it will do any harm over the country to publish the results of any experiments I have made or any series of cases I may have promulgated for the profession to discuss. I have never found the profession so rabid that it would take things up about proper legislation or about study of the same so I do not feel any damage will be done to their tender young minds by the process.

Dr. Bacon has properly called attention to the point I was going to make in regard to separation of the membranes. That it seems to me is no objection. It is far more objectionable than the introduction of a bag. I do not believe that the introduction of a sterile bag for three hours and certainly must all be as detrimental to the patient as the separation of the membranes with the finger. In fact in clinics where the finger is carried in it usually is without dilatation of the vagina by the stilet which is likely to carry flora and fungi from the vagina to the cervix than a bag which is introduced with clean instrument and a pull down the cervix through a vagina opened by a speculum. However I have no objections on that point if operators get no bad results.

The use of quinine and castor oil has been tried quite thoroughly by Wesley Hooper and I think we find it works about two out of five cases. In fact many of our bag cases were given castor oil and quinine on the afternoon before in the hope they would go into labor before the bag was inserted the following morning and in some instances this happened.

Dr. Bacon wished to know in how many cases we are using the bag. In this series we have used it in about two thirds of the cases that have come into

the hospital. In the first series we used it on 100 consecutive cases.

In reference to the point Dr. Van Hoosen makes regarding the bag and scopolamine morphine analgesia I may say that my own practice differs considerably from hers. It seems to me I would not use scopolamine morphine analgesia until labor pains were well under way by use of the bag or any other means that seemed to start labor. I should be opposed to giving it before the bag was put in.

Dr. Paddock wished to know about the number of bags I have rarely used but one bag a No. 4 Voorbees bag. I have never used two consecutive sizes. I have sometimes introduced a second bag when either a rupture has occurred or the bag has been expelled prematurely.

In the use of the bag I find in only five cases that chloroform was employed. I have carried out the work with multiparae and primiparae and I cannot remember but two cases where it was really necessary to give any kind of anæsthetic and I think the neurotics that come into our service are fully as numerous as may come into the service of any of the members of this society. The bag slips in easily without any particular difficulty and the woman complains only about the introduction of the speculum.

As Dr. Goldstone has suggested my internes introduced the bags right along without any difficulty whatever. This brings me to another point. I have noticed that pains induced by the bag are not as a rule so powerful as the pains that come on spontaneously. But this makes no particular difference. In two of the cases where the bag came out prematurely from rupture the woman was in the hospital for a day or two. The secret of all bag work is to keep the doctor or skilled assistant must be in constant attendance and try at the case as if it were in the surgical. He stays with it until through. That is not a hardship when the time can be chosen. I three or four cases I recall the bag came out and the women were so nervous that their head nurse or my wife stayed on those cases and managed the uterus for an hour until the pains came on strongly and in two instances labor terminated in two hours and in another it was something like four hours. It is not possible to maintain sterility of the obstetrical field as Dr. Bacon has said. It is not possible always for these cases to come through in a definite length of time. In one instance my head nurse was on her vacation a woman from the ward was given to me in terms of instruction purposes to put in a bag. The nurse in charge was indifferent and the intern as chief. They put in a bag and were off and left the woman. The bag came out in two hours and a half and about half an hour afterward the pain stopped. I came in the afternoon and found the patient had been abandoned and the man standing there wondering what she should do and there was a nobody at hand to direct her. It was an accident for the bag but it was not properly

managed I did not insert another bag nor did I ask that interne to take another case. The woman went into spontaneous labor two days later and she delivered in half an hour. This case would have terminated as usual if the woman had been carefully watched. One cannot achieve success in these cases unless he pays close and strict attention to them any more than he can secure success without paying strict attention to the details of any other surgical operation.

Sixteen per cent of forcep may seem to be a large number of forceps deliveries as these cases go. There are two explanations for this however. Our foremost idea was to make our series of cases complete in the way that we have tried to do it as a means of demonstrating that the shortening of the labor process is a means of preserving the immunity of the individual and I believe there is less danger in the use of forceps even to 16 per cent than in allowing the cases to go on for eight or ten hours longer in the hope that rotation will take place and then using forceps of necessity. I believe it is only fair to the woman to do that rather than take a chance on the indiscriminating powers of nature. Furthermore I believe that the danger of infection in these cases of prolonged labor is very great but there is another point which Dr. Baer very properly mentioned and that is in regard to the cases which go into spontaneous labor. We have seen them go through we have seen them run a septic temperature and die without any interference whatever or without any examination. Now then if we can demonstrate that so little interference as that which is produced by the introduction of the bag can be conducted without the danger of infection then we have a point gained in regard to what constitutes infection and how much can be done without bringing on infection. It seems to me if we can run 200

bag cases without infection while a woman who has a normal delivery and spontaneous onset of labor has infection as she often does without examination it certainly should not be attributed to the bag or any other means of interference in case infection should occasionally take place. Furthermore 16 per cent of forceps cases is not a high average for the service of a specialist toward which the high strung the neurotic the overcivilized and the anatomically imperfect naturally gravitate. A man doing general practice among strong normal women might possibly show a smaller number of forceps deliveries but the specialist necessarily gets more pathology and therefore more operative cases.

In conclusion I think my success with the bag may be attributed to our constant watchfulness over the patients. Failures will necessarily occur by any method such as the one of the interne which I mentioned. I have never had but two failures with the bag. I have had in mind the paper of Dr. Lynch and it seems to me in all of those cases where he failed and his opinion of the bag was very radically opposed to mine the patients were not carefully watched and the patients were not pushed through so to speak as we understand the bag from our experience at present. If they had been it would have been a very different paper that Dr. Lynch would have written. My own feeling about it is that the bag is a very successful method of inducing labor and yet I would not deny the great advantage that comes occasionally from the castor oil and quinine nor would I deny to any one else the use of methods which appeal to him. I use this method because it appeals to me as advantageous and I believe it has a definite place in scientific procedure but to secure the best results the process must be thoroughly understood and carefully watched.

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The first three chapters deal with the foot normal and abnormal and the correction of the latter The next three deal with joint injuries and their sequelae Then in turn are discussed the spine and its abnormalities nerve injuries united and mal united fractures bone grafting and fixation methods

These Medical War Manuals make a very interesting and valuable series both to the military and lay physician

**I**N order to meet the demands of the day we have the new edition of Blair<sup>3</sup> Its revision is such as to incorporate the latest war data concerning gunshot injuries of the face and jaws and is compiled by the direction of Subsection on Plastic and Oral Surgery of the United States Army Especial attention is given to injuries and infections of wounds about the mouth and jaws and to the treatment of such wounds which require especial training along lines of prophylaxis and mechanical appliance Reconstruction of the face—that all important topic—is treated in a most masterly fashion New

conditions as trench mouth and the like are given due consideration Many chapters are completely revised adding much to the former text and many new illustrations The fact that this work is used as a text by the section on face surgery of the United States Army speaks for its thoroughness and completeness One can unhesitatingly say this work is the final word on the topic for the present

**THE** success of a publication depends not alone on the facts incorporated therein but upon the presentation of these facts in a logical and pleasing manner In no work is this more clearly illustrated than in the new volumes edited by Binnie<sup>4</sup> In reading these two volumes through one feels as though he were at an interesting clinic each clinician a master the flow of language easy the facts presented in brief and concise words One is refreshed to find something new in the line of surgical treatises in that these volumes are not of the usual stereotype textbook variety but a work meant for the thinking surgeon The authors take for granted that the reader has a reading and basic knowledge of the topic and they round out the subject and give just the information desired It would indeed be difficult to choose the outstanding chapters in the work after reading Paul on intestinal obstruction Mayo on the large intestine Ochsner on appendicitis Morrison on the stomach Fenwick on the bladder and Lane on fractures of the lower extremities

The surgery of the extremities in volume III is classic in that for once it is given a position in keeping with its importance This topic is today a greater problem to the surgeon than abdominal surgery and yet almost all authors give it a position of minor importance in their publications The section on diseases of the upper extremities by Lewis is a masterpiece and it alone should place these volumes in the hands of every surgeon

One cannot lay these volumes aside without saying that the surgical profession has today something new a thorough comprehensive treatise on regional surgery

**THE** little volume by Moynihan<sup>5</sup> is a compilation of addresses delivered in Chicago during the author's recent visit on subjects which much concern the military surgeon of today The facts given were obtained by extensive work on the battle fields of France and Belgium by this distinguished surgeon as well as by his observation of the work of other investigators Of special interest is the address on gunshot wounds of the lungs and pleura Lung surgery is taken from the misty realm of makeshift surgery and placed in the bright light of twentieth century progress

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# SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE PUBLISHED MONTHLY

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NUMBER 3

## ON INJURIES OF THE CERVICAL SPINE<sup>1</sup>

By JOS. H. RANSOHOFF, M.D., F.A.C.S., I.P.C.S. (ING.), CINCINNATI

A BROKEN neck has from time immemorial been potential of a speedy death and if the fracture is of the right kind recovery is impossible. As if the break in the cervical spine were insufficient there quite often occurs with it a fracture of the base of the skull to make the end doubly sure.

Within two years we have had in the Cincinnati General Hospital no less than three cases of fracture of the cervical spine with fracture of the base of the skull. In one of these there was also a fracture of the fifth lumbar vertebra. In each of these cases there was a great deal of shock, a condition which curiously enough is not ordinarily associated with cord injury. In one of these cases the temperature rose to 110° four hours before death and 18 hours after the receipt of the injury.

Even in very high fractures shock is often absent. In the case of a man who died on the fourth day after injury there was found a fracture with dislocation of the axis. Although this man lived nearly four days there was no shock, and notwithstanding the extensive derangement in the atlas there could have been only a partial cord disintegration.

The X-ray findings of fracture dislocations of the cervical spine with extensive disorganization of the cord are often disappointing since they fail to reveal a degree of derangement of the column commensurate with the cord injury. For example in the

case of A 4115 (Sheridan Fig. 1) where death resulted after a subtotal paraplegia the roentgenogram must be carefully studied before the break in the anterior lower margin of the fifth cervical body can be seen. There is no displacement. There was no weakness in the upper arm and no loss of sensation. There was marked weakness of the flexors and extensors of fingers and hand. The line of demarcation began at the third intercostal space below which there was complete anesthesia. Below this line there was flaccid paralysis and loss of deep reflexes. There was extreme arteriosclerosis. Sloughs formed on the buttocks and heels in a few days but the patient lived seventeen days.

The case of B 7671 to be shown later further illustrates this point. A fine abnormal line between the transverse processes indicates where the dislocation had been. Except for some control over the deltoids there is a complete flaccid paraplegia. Exitus occurred 60 hours after injury was sustained.

This discrepancy between the roentgenographic findings and the cord changes are doubtless due to the fact that after the accident either spontaneously or by the handling of the patient a reposition of the parts takes place to something like their normal relations. Particularly is this true of the cases in which luxation plays a great role. While Chipault opposes this view of spontaneous replacement Thoburn believes that in the cervical region particularly reposition is



Fig (A 4 5)



Fig (F 7 d)

twice as common as is the permanent displacement. Our study of the roentgenographic findings as we have seen supports the contention of the English surgeon and brings into the limelight the futility of interfering for deformities of the column alone since the spontaneous relief of the latter or that following manipulation fail in so many instances favorably to influence the damaged medulla.

There were altogether 14 subcutaneous injuries to the cervical spine of which 6 died. The complications in the fatal cases were fractures of the base of the skull as already alluded to or other internal injuries. Eight of the cases recovered and of these 6 presented neither cord nor nerve root symptoms of any kind. Two of the cases presented cord or cord and root symptoms. In addition to these there were two cord lesions from penetrating wounds, one of which died.

In most of our fatal cases the injury was to one of the lower cervical vertebrae, the place of election where the more movable portion joins the more fixed segment at its junction with the upper dorsal. One exception was in a case of fracture of the third vertebra. The other was a fracture dislocation which was admitted to the neurologic service while

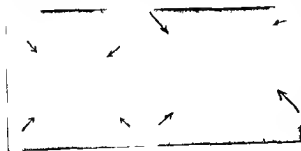


Fig 3 (I J)

Fig 4 (L J)



Fig (A 4 6)



Fig 6 (A 6 4)

in a postepileptic mania. In an attempt to escape from the police he jumped from a window and sustained his injury. A satisfactory neurologic examination could not be made since the patient was deeply comatose. The pupillary reaction was sluggish, the left pupil being the larger. Both arms and hands were moved without intent and both legs although paralyzed responded somewhat to plantar irritation (Townsend III.) The patient died within 72 hours in deep coma.

Although the roentgenogram failed to reveal any injury to the skull it is certain that death was due to a cerebral lesion. The roentgenogram shows a fracture of the odontoid process with extensive comminution of the atlas.

In none of the fatal cases was an operation performed. In withholding from surgical interference my colleagues and I evidently incline to heed the dictum of Horsley to wait. If the lesion is acute and in the cervical region then certainly wait. As regard the dorsal region better to wait a little. As regards the lumbar region I do not think you want to wait to operate.

In a report from the Massachusetts General Hospital by Hartwell from 133 fractures of the spine 40 patients were subjected to operation, 38 to laminectomy and 2 to an attempt to remove the deformity by manipulation. Taken as a whole the result of expectant treatment in the cases equal those obtained by the operative treatment and the results of laminectomy do not justify an argument in favor of operation but rather serve as a warning against radical surgical treatment. Indeed there are some cases in



Fig (B 2544)



Fig 7 (B 544)

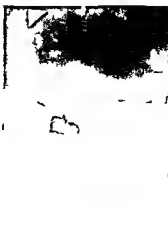


Fig 8

which an operation seems positively indicated and in which if performed would be held responsible for recovery if it took place. But such cases seem quite as often to recover without an operation.

The following case observed in private practice 23 years ago illustrates a complete recovery after more than a year from what appeared to be a severe transverse lesion of the cord in the fifth cervical segment.

L. J. age 27 on November 24, 1895 while diving struck his head on the concrete bottom of a pool in shallow water. He remembers floating to the top of the water but could not lift his head out of the water. He did not lose consciousness and felt that he might drown before any one discovered him. Assistance came however. It was after he was brought home that he felt that he was completely paralyzed from the shoulder down and that the paralysis was not complete from the start. An examination made by Dr. Maury showed a fracture of the fifth and sixth cervical vertebrae. He was treated by Dr. Maury with a plaster cast and head extension. When this man was seen by me 6 months after the injury the condition was practically unchanged. After the year the paralysis gradually improved and now 23 years after the accident there is slight weakness of the arms in lifting and some of the muscles of the shoulders have slightly atrophied. The roentgenograms which were recently taken by W. S. Lawrence of Memphis (Figs 3 and 4) show that there is an almost complete coalescence of the fourth, fifth and sixth vertebrae.

In this connection the case of F. M. age 20 is also interesting. Unfortunately the roentgenograms cannot be found.

On the day before admission the patient fell down some steps and was rendered unconscious. For a short time after gaining consciousness she

was irrational and confused. There was localized tenderness over the fifth and sixth cervical spines and crepitus could be easily obtained. There was paralysis of both arms below the shoulder with almost complete paralysis of the triceps and extensor muscles of forearms and fingers on both sides. A great deal of pain is complained of in the arms but not well localized. Touch sensation is entirely absent over the dorsum of both hands and the extensor surfaces of the forearms and is much impaired over the left arm to the shoulder girdle. Pain sensation over the dorsum of the hand and the extensor surfaces of the forearms is entirely abolished. Pain sense is also diminished over the flexor surfaces. There is paresis of both legs more marked in the left. The dorsal extensors of the foot seem chiefly affected. There is urinary and fecal incontinence.

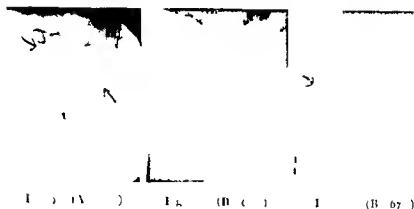
The neurologic diagnosis read: Destruction of rootlets both anterior and posterior coming chiefly from the sixth cervical segment resulting in almost complete paralysis of the triceps, extensors of the hand and fingers, the major pectoralis on the right and left side. Also a zone of sensory destruction covering the back of the hand and forearm.

From the involvement of the lower extremities and the loss of functions of vesical and anal sphincters an incomplete cord lesion was surely present. When this patient was discharged from the hospital within two months she had entirely recovered except for a paralysis of the extensor muscles of the fourth and fifth fingers of the left hand.

Another case with even more serious cord lesion that quickly recovered without operation was that of Spencer Lynn (Fig 5 A 4146 age 57).

Falling down stairs he sustained a fracture of the spinous processes of the third, fourth and sixth cervical vertebrae. Pain sensation in the upper extremities was normal, absent in the lower. There was muscular paralysis of lower extremities to the hip, patellar reflexes much exaggerated, ankle





lateral fracture of the transverse process of the sixth vertebra. The fracture is complete and the complete transverse process is missing with a distance of one inch from the fracture.

In these cases which recovered without operation the recovery would have been attributed to the operation had not been performed.

The mortality of our cervical spine injuries is less than one per cent. This is in marked contrast with those recorded only a few years ago. Chipault had one with one death and one improvement. Bergman while at St. Peterburg 16 cases with 16 deaths. Guy Hospital 36 cases with 36 deaths and Frank Hamilton 18 cases with 18 deaths. The cause of this discrepancy is of course the graphic manner in which injuries to the spine are now displayed white on black. Our immediate forbear in surgery based the diagnosis of spinal lesions almost wholly on the narrowing of the spinal canal which they produced and the damage to the cord consequent thereon. The localized pressure tenderness muscular rigidity restricted movement and irregular alignment of the spinous processes were of necessity only potential factors toward diagnostic probabilities. Fracture of the spinous processes were thus recognized but these are as a rule not limited to the spines but involve the bodies as well. The roentgenograms of cases A 2614 (Lang Fig 6) and B 2544 (Hampton Fig. 7) show this admirably. As to neurologic findings in both cases were negative. They did not make the diagnosis certain. As we have seen the outcome in the class of cases formerly

regarded as fracture of the spine is no less or little less fatal today than it always has been. It is self evident that we now recognize with greater ease injuries to the vertebral column.

The taking of plates through the open mouth is first advocated by Griffiths, a valuable addition to X-ray study of the cervical spine. Figure 8 shows a bullet located by a roentgenogram taken through the mouth. Although it seems to be lodged against the spine it is behind the spine and has not touched it. The track of the bullet can easily be followed from the point of entrance in the parotid region to its final lodgment behind the spine.

The frequency with which the cervical spine is injured without cord involvement is illustrated by the number of cases recorded in less than two years in the Cincinnati General Hospital. The experiences in the Cincinnati General Hospital is of course not unique. Hartwell (1) during 6 months service in the male surgical division of the outpatient department of the Massachusetts General Hospital reports 10 patients who sought relief for pain in the back and who were found to have a fracture of the spine and one patient with spinal fracture who was treated in the orthopedic division. Not one of the cases had at any time had any motor or sensory paralysis or sphincteric disturbance. Of the series 8 cases were compression fractures, one was a fracture dislocation and 2 were fracture of the transverse processes of the lumbar vertebrae.

Curiously enough the fatal cases in cervical fractures are mostly in the lower four vertebrae and are compression fractures from

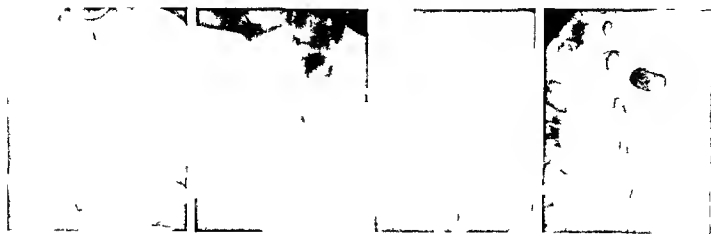


Fig. 11 (B 864)

Fig. 12 (B 864)

Fig. 1 (B 7936)

Fig. 13 (B-6873)

indirect trauma. We saw no cases of tear of the intervertebral discs which occurs in less than 1 per cent of the cases.

Only one case could be positively diagnosed as a direct fracture (A 7521 Weaver Fig. 9) and this was brought about by a blow with a heavy wooden club.

The fracture was through the lamina of the second cervical vertebra with considerable forward displacement of the body. The lateral movements were very much limited and caused a great deal of pain and although there was considerable dysphagia there were no cord symptoms whatever. When one considers the damage done to the vertebra and the amount of displacement and narrowing of the canal it seems a marvel that the cord escaped fatal damage. The same degree of overlapping from trauma in the lower cervical vertebra would almost certainly have produced fatal infringement on the lumen of the canal and crushed the cord.

In one other case there was a suspicion of direct injury.

The patient was struck by a wagon but there was nothing to indicate where the injury was inflicted (B 671 Surratt Fig. 10) except a slight abrasion over the coccyx. Curiously enough this was the only case of the entire series of a pure dislocation without fracture. The body of the fifth vertebra on the stereoscopic plate appears dislocated on the sixth but if the pictures were presented without any accompanying history it would be improbable in my judgment that any one would make the diagnosis of dislocation. A white line on one side indicates a diastasis of the articular processes. Nevertheless in this case the Thoburn syndrome was complete and priapism was present. The patient died from complete transverse lesion 2 hours after admission.

It may be observed that priapism was present in all but one of our fatal cases. It is

almost always present when there is a complete cord disorganization and is therefore a most ominous sign.

In all of our cases with one exception the neurologic evidences of complete cord injury were synchronous with the injury itself. This is a rule to which there are very few exceptions. Thus of 67 patients from the Massachusetts General Hospital who had signs of cord lesions in 66 the onset of paralysis was immediate and in only one was it gradual. In this connection the case of L. Johnson (B 8641 Fig. 11) of our series is of interest.

This was a colored man who received a stab wound of the neck on a level with the fifth cervical vertebra. He walked into the hospital from the ambulance. A hematoma the size of an egg containing a clot was cleaned out in the receiving ward and the wound sutured. When the patient was asked to get up from the operating table after the sutures were placed it was found that he could not get up and on examination a complete paraplegia from the shoulders down was discovered. He was unable to use either leg. The knee jerks were normal. Evidently the paralysis was the result of a hemorrhage and for this reason a laminectomy was determined upon. The roentgenogram showed a fracture of the spinous process of the fifth and one of the body of the sixth without displacement. It seems remarkable that the knife blade could have been withdrawn intact and that the cord was not cut. As happens occasionally in laminectomy in the cervical region respiration was interfered with and notwithstanding the establishment of artificial respiration the patient died on the operating table before the membranes could be exposed. An autopsy could not be obtained.

In the treatment of fractures, dislocations and fracture dislocations of the cervical spine we have not only refrained from open



# THE UTILITY OF END-TO-END ANASTOMOSIS BETWEEN SMALL AND LARGE INTESTINE<sup>1</sup>

By D C BALFOUR M D F A C S ROCHESTER MINNESOTA

THE restoration of the continuity of the small and large intestine following resection of the ileocolic coil is not the least important step in the operation. The exploitation of colonic resection for intestinal stasis has at least resulted in demonstrating the disadvantages of lateral anastomosis between the small and large intestine and in the rather general adoption of end to side union. The latter method has no seriously objectionable features but it involves two steps which are essentially additional namely the closure and inversion of the end of the large bowel and the formation of a separate opening in it for the implantation of the end of the small intestine. Axial union in any part of the intestinal tract is manifestly superior to all other methods provided the operation can be done with safety with the preservation of good function and with the avoidance of late complications.

Recently Lockhart Mummery has exposed some of the fallacies in the attitude toward axial union of the large intestine showing that the relatively high mortality and morbidity from leakage are not due to inherent faults in the operation and has described a method by which end to end anastomosis of the colon can be done with safety.

A more or less analogous situation exists in regard to end to end anastomosis of small and large intestine. It is quite evident that axial union between ileum and colon is given little or no consideration in the literature and in so far as we are aware the procedure is not utilized to any extent among surgeons in this country. Our experience has shown that end to end anastomosis of ileum and colon can often be easily and safely performed which leads us to believe that the general attitude toward the operation is unwarranted. It is for this reason that I bring the method to your attention.

It should first be said that we have thus far recognized the apparent limitation of axial

union to those cases in which there is a dilatation of the small bowel due to a chronic obstruction from some well defined pathologic condition such as cancer (Fig 1) or hypertrophic tuberculosis. Under such circumstances the method has been exceedingly satisfactory. Resections of the ileocolic coil for conditions other than those associated with such definite pathologic processes are relatively rare in our Clinic but when these other indications do arise and the ileum is small there seems to be no reason for abandoning the end to side anastomosis. At the same time axial union has been so satisfactory in the group of cases in which the caliber of the small intestine more or less approximates that of the large intestine it is quite possible that by the employment of technical procedures (those of C H Mayo for example) to increase the caliber of the smaller segment by cutting the bowel end obliquely without sacrificing its lumen or splitting the bowel opposite its mesentery the scope of axial union may be extended to include cases in which little or no dilatation of the small intestine has occurred (Fig 2B).

In carrying out end to end anastomosis between ileum and colon by suture we have followed in general the method used by Lockhart Mummery in axial union of the large intestine the anastomosis being made in the following manner. The resection having been completed the two stumps of the intestine are isolated by protective gauze pads rubber covered clamps are placed on each segment of bowel or 3 inches from the end the clamps at the extremity of the intestine are removed and by repeated swabbing both ends are thoroughly cleaned out. The ends of the intestine are now approximated by two traction sutures each of which is placed about half way between the anterior and mesenteric borders (Fig 2A). They serve a most important purpose in maintaining a correct alignment and in preventing



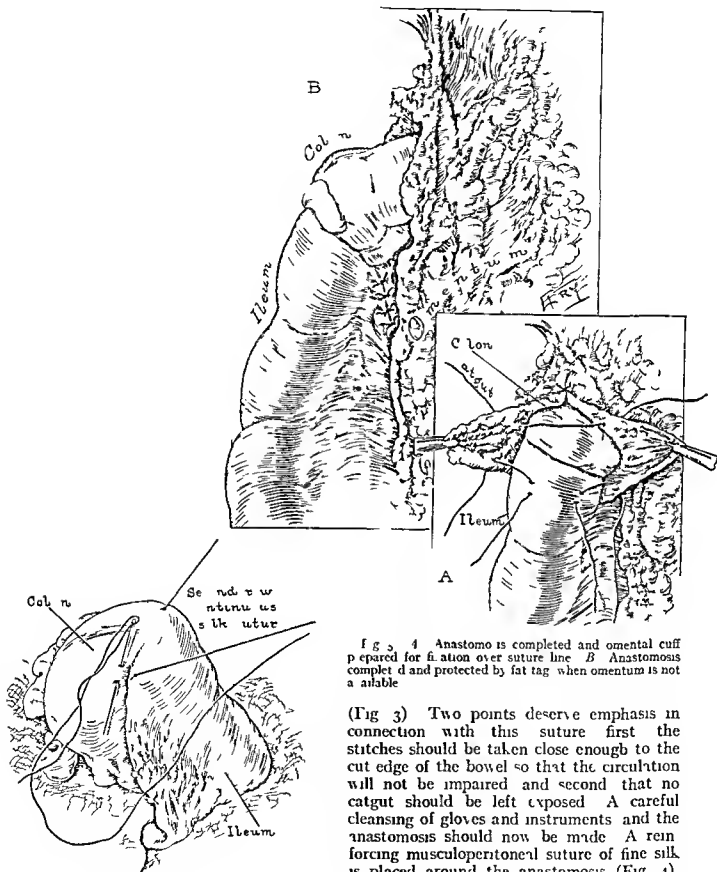


Fig. 4. Anastomosis is completed and omental cuff prepared for fixation over suture line. B. Anastomosis completed and protected by fat tag when omentum is not available.

(Fig. 3) Two points deserve emphasis in connection with this suture: first the stitches should be taken close enough to the cut edge of the bowel so that the circulation will not be impaired; second that no catgut should be left exposed. A careful cleansing of gloves and instruments and the anastomosis should now be made. A reinforcing musculoperitoneal suture of fine silk is placed around the anastomosis (Fig. 4); the two borders of mesentery are brought in apposition by catgut sutures; and finally the

Fig. 4. Second suture of silk completing anastomosis anteriorly.

anastomosis is protected by available omentum or fat tags (Fig. 3). This protection may be most satisfactorily made by utilizing a collar of omentum (which can be stripped back before the intestine is resected (Fig. 1) to surround the anastomosis very much as the intestine itself is used to protect the suture line in the tube method of anastomosis. The entire held is now cleansed, gloves and instruments are changed and the wound closed without drainage. Drainage predisposes to fistula and should be omitted unless exceptional circumstances demand it.

The results obtained by end to end anas-

tomosis between ileum and colon conducted in this manner have been excellent and having proved the safety of the method its obvious simplicity is sufficient for its recommendation. We believe that if the operation is carried out with strict attention to every detail the utility of axial union of small and large intestine will be quite apparent.

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## THE ETIOLOGY OF URETERAL CALCULI<sup>1</sup>

By GUY I. HUNTER, M.D., F.A.C.S., B. TIMO, D.

F. m. h. Gynecology (D. p. m.) f. h. f. h. H. p. k. U. by H. p. l.

FOR the past two years I have been particularly interested in the subject of ureteral stricture and I wish to report further experience in the work because I am almost daily learning some new feature about it and becoming more impressed with its importance. I am simply amazed that we have all been overlooking this lesion so long and so thoroughly as we have. As patient after patient suffering with ureteral stricture and its effects consults me I ask myself what we have been doing with these patients in the past.

Up to November 1915 I had recognized 50 cases as suffering with ureteral stricture. At our White Sulphur Springs meeting in December 1916 I discussed 9 cases, 42 of them having occurred within the year after looking up the records of my original 50 cases and getting especially interested in the subject.

In this past year I have seen approximately 200 additional cases.

This experience with about 300 cases of ureteral stricture has been answering in a degree the question I have just mentioned. Their histories demonstrate what has been their treatment in an epoch in which we have

failed to recognize the frequency and importance of ureteral stricture as a clinical entity. Many of them have been fortunate enough to escape operation and because we could discover no lesion to account for their persistent symptoms we have put many of them down as neurasthenics and if they could afford it they have had rest cures or because of their gastro intestinal symptoms we have sent them to the gastro enterologists to be drugged without relief or we have sent them to the orthopedist to have braces for their hip back and sciatic symptoms.

Of those who have not been so fortunate and who have fallen into our surgical hands the largest number have lost a normal appendix, many have had an ovary removed some have had hysterectomies without relief. Some have had a useless gall bladder operation. Many have had a fixation of the kidney without relief of symptoms because the symptoms the slight hydronephrosis and the prolapse of the kidney all depended on a ureteral stricture. In some the stricture has been neglected so long that we have had to sacrifice the kidney.

This appeals to some of you as an imaginary list of ill advised treatment but I can

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assure you that all of these operations and many more have been recorded in these patients' histories and some of the victims have not escaped with but one of these operations but have had two three or more of them my most unfortunate patient having had 8 operations 7 of them abdominal. These patients are consistent in still complaining of their original symptoms until the ureteral stricture is diagnosed and dilated.

Too many of these cases have been in my own list of useless operations and I am now consulted frequently by some former patient who tells me of the operation I did one two or more years ago without giving relief and brings the typical history of ureteral stricture which I find in her original records.

*History of the theories concerning the etiology of urinary calculus.* One of the interesting developments in this study of ureteral stricture and its influence on other important lesions of the urinary tract has been the demonstration that many stones in the urinary tract are probably first formed in the site of a stricture. A review of the literature shows that ureteral calculi have generally been ascribed a renal origin and that the development of ideas concerning the etiology of urinary stone may be classified roughly into three periods. The first period dates from early medical history to the latter part of the nineteenth century and may be called the

chemical epoch in which writers sought to explain the origin of stone in some obscure change in the composition of the urine. The second period includes the last two decades of the last century and the first few years of the present and may be called the bacteriological epoch in which writers emphasized the influence of micro organisms on stone formation. The third period overlapping on the second is synchronous with the recently developing accurate methods of study and treatment of ureteral diseases and may be called the mechanical epoch in which injuries and inflammatory diseases within and outside of the ureter have been invoked as frequent causative agents in ureteral stone formation.

The chemical theories include those dealing with heredity race climate diet drinking

water ingestion of alcohol incidence of gout and rheumatism faulty metabolism etc and date back at least to Galen (see Neuburger and Pagel *Handbuch der Geschichte der Medicin* II, II and III 80) who claimed a relationship between stone formation and gout. Paracelsus spoke of an animal cementing substance from the food a tartar filled mucus as essential in the formation of the sperma calculi. Sydenham and Boer have considered a specific diathesis a characteristic variation of the metabolic assimilation to be fundamental and to result in a crystallization of the stone forming substance held in excess in the urine.

Van Helmont attributed stone formation to the coagulation of uric acid which came from the existence of potential alcohol and the breaking up of urinary ferments.

Fourcroy and Vauquelin considered the organic cementing material to be albumin and gelatin and they and later Scheele (1776) investigated the solid elements concerned in stone formation. Scheele referred to the Steinsäure the stone acid or uric acid phosphorus and saccharic (oxalic) acid ammonia and the alkali earths and Fourcroy classified the stones as consisting of one two or more than two of the stone forming materials.

At the end of the eighteenth century many authors notably Wilson 1795 wrote of the influence on stone formation of the frequent use of acid foods and drinks and of the drinking of water rich in lime and of the influence of sedentary habits.

In 185 von Walther defined the spontaneous formation of calculi (i.e. those formed without the aid of foreign bodies) as an organically vital process pointing out that with the same materials outside the living body only a sediment forms.

Meckel von Hemsbach 1856 advanced the theory that the organic cementing material was the product of an advancing inflammatory condition a catarrhal affection of the urinary tract. Meckel's stone forming catarrh.

In 1884 Ebstein by careful dissection and analysis of stones concluded with Fourcroy and Vauquelin that stones formed in the



urinary tract contain a framework of albuminous substance. He thought this organic material resulted from a catarrh of the urinary tract and a sloughing of the epithelium thus forming a groundwork for the impregnation of the inorganic particles of the urine.

Posner accepted these two factors as important but thought that in addition to the sloughing of the albumin framework and its impregnation by crystalline bodies we must have a third factor in stone formation viz a slowing of the urinary stream.

Kuester reviews the history of the etiology of urinary calculi. He dismisses the views formerly held as to the roles played by climate drinking water and racial tendency. Many cases even in the third and fourth decades of life may be traced to the uric acid infarct in the young. Gout is a cause cannot be proved although the two conditions are often present in the same individual. He quotes Ackerman as viewing stone formation as due to a retained hyaline cylinder in the kidney pelvis and von Lecklinhausen as considering a blood clot the foundation for stone. Kuester says that if it be true as stated by Moritz and Mendelsohn that each stone particle has an albuminous center then stone formation loses its specific character and belongs on the borderline between a physiological and pathological occurrence.

A. E. Roberts of the English Army attempts to explain on dietetic ground the unusual prevalence of bladder stone in certain parts of India where the inhabitants are vegetarians and where gout is almost unknown. Of 3041 cases of stone in the bladder operated upon in one year in India 1482 or nearly one half were in the Punjab where the inhabitants eat cereals and leguminosae as opposed to the rice diet of other portions of India. These diet stuffs yield urine which is as acid as that due to a meat diet under normal conditions of digestion because they are rich in albumin and phosphates and in calculus. The inhabitants of the Punjab have a deficiency of salt

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which is so necessary with a vegetable diet and Roberts considers this the cause of their proclivous calculus formation. He then takes up what Hirsch in his great work on *Geographical and Historical Pathology* calls the mystery of the excessive prevalence of stone in the tropics while gout is practically unknown and attempts to show that absence of sufficient NaCl and excess of K in the diet renders the blood relatively alkaline resulting in the dissolving and excretion of the uric acid as far as the bladder. On the other hand a free ingestion of NaCl results in relatively acid blood with a storage of the uric acid in the spleen and joints (gout).

The bacteriological theories concerning stone formation are a natural outcome of the development of bacteriology and a clearer knowledge of the role of microorganisms in pathological processes.

Naunyn's work in showing the relationship between gallstone formation and infections undoubtedly stimulated similar investigations on the etiology of urinary calculi.

M. L. Harris advanced the thesis that all renal calculi are of bacterial origin and supported this by evidence collected from the literature and by experimental and clinical data.

The subdivision of kidney stones by Albarran into primary and secondary stones the former being considered of non bacterial origin and the latter of bacterial origin however is of great value as will be seen later if we have the classification not on the character of the stone but on the state of the kidney. In primary stones the bacteria are eliminated by the healthy kidney. They develop in the urine in the tubules calyces or pelvis where they lead to the stone formation as above described without invading or setting up pathological changes in the kidney proper.

In secondary stones the kidney is already the seat of active bacterial invasion and the stone formation is subsequent thereto. The great danger of primary stones is that they may determine bacterial invasion of the kidney in which case they thereafter partake of the nature of secondary stones.

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T R Brown<sup>1</sup> made accurate bacteriological studies of seven cases in which infection of the renal pelvis or the substance of the kidney was associated with the presence of stone. Careful qualitative chemical analyses of the calculi were also made and his conclusions were that with the proteus vulgaris and other alkaline producing infections we may expect to find stones made up of the alkaline earths while with the colon and other infections associated with acid urine we may expect to find stones made up of the organic materials such as urates and oxalates.

We have seen that the formation of stone in the urinary tract has been a subject of intense interest and speculation since early medical history and that we still have problems to solve concerning its etiology. Scientific knowledge of the diagnosis and treatment of urinary calculus has awaited the development of abdominal and pelvic surgery during the last quarter of the nineteenth century and the early years of this century. This knowledge and accuracy of treatment has been tremendously accelerated by the development of the specialty of urology with its use of the cystoscope, the renal catheter and roentgenography.

We cannot emphasize the rapidity of this evolution more forcibly than by quoting from a paper by Henry Morris of London published in 1884 enunciating the principles concerned in the treatment of calculus impacted in the ureter. As regards the question of surgical operation in which there is impaction in the ureter there is no doubt but that in some of them the calculus could be removed by nephrolithotomy or pyelonephrotomy and there is good reason to believe that with the more frequent resort to digital exploration of the kidney through a lumbar incision a calculus impacted in the upper end of the ureter will not infrequently be detected and extracted through the loin.

Calculi impacted in the intermediate parts of the ureter are practically beyond the reach of the surgeon.

It has been the development of abdominal and pelvic surgery and especially of urology

that has led to ureteral surgery and to a gradual appreciation of the importance of mechanical factors in the etiology of ureteral stone formation. A few quotations from recent literature will show that the ideas held by the author are at variance with many of our past ideas but that they are confirmatory and elaborative of some of the recent theories rather than original.

Israel<sup>3</sup> says the cause of stone formation is still in the dark. One theory is that uric and oxalic stones are due to a poor oxidation of the proteids. It seems certain that heredity plays a part in the predisposition to stone formation. The uric acid and cystin stones run in families. It is also certain that in some families gout, rheumatism, diabetes mellitus, nephrolithiasis and bladder stones alternate. Subcutaneous trauma may play a role. Injury to the kidney causes bleeding. It is more probable that latent stones begin to give trouble after trauma. It is only hypothetical whether there is such a thing as Meckel's stone forming citruria. Israel cites a case due to stenosis following lateral fistula due to injury to the ureter by a clamp during vaginal hysterectomy. Another case had colic following misplacement of the ureter by a vaginal fixation. Therefore one should always remember that a former gynecological operation may be the cause of kidney colic. The cramp-like pains due to the rare condition of primary ureteritis cannot be diagnosed from kidney stone colic. A diagnosis is practically impossible when the colic is due to the form of ureteritis in which small concretions are passed these having been formed in the ureter their nucleus being a small organic mass. Colic due to primary stricture of the ureter is very rare.

Benjamin R. Schenck<sup>4</sup> speaking on the etiology of ureteral calculus states: Calculi formed primarily in the ureter are very rare. While they may result from urinary deposits about the site of an old infection or ulceration they more frequently occur after operations on the ureteral walls as when a non-absorbable suture becomes the nucleus of an irregular deposit of phosphates or urates.

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The presence of a foreign body such as a calculus beginning its descent must cause a spasm of the muscular coats and thus we consider an important factor in causing the arrest of the stone. Added to this we have in cases where infection is present inflammatory reaction and swelling of the mucosa which later cause thickening and rigidity of the ureteral wall and finally stenosis at point of arrest. Such is far as is known are the general etiological factors.

K. C. Bryn speaking of the etiology of ureteral stone state. The possibilities of transmural bacillary infection must be considered as a constant menace to the ureter integrity particularly if its mucosa has been insulted by the frequent passage of a concentrated urine loaded with irritating crystals such as oxalate of lime or if indeed its wall has either mechanically or by processes of inflammation been restricted or damaged as may be instanced in childbirth appendiceal ovarian tubal and peritoneal exudates and consequent fibrotic replacements.

He also says as another and more recently developed causation of primary ureteral stone must be mentioned *stricture*. The acquired variety has been briefly mentioned above. In regard to the *congenital* Bottomley records 56 cases of congenital stricture of the ureter. Such a stenosis if complete would result in atrophy of the kidney or hydronephrosis. If of small caliber there would be proximally a dilatation and thickening of the ureteral wall. The opportunity here through stagnation for stone building would seem evident and is directly comparable to stone formation in a bladder behind an obstructing prostate.

Guteras<sup>7</sup> considers most ureteral stones as secondary the rare primary stones are of a phosphatic origin and small.

J. M. Thompson Walker<sup>8</sup> says. Very rarely a calculus is formed in the ureter itself. He gives examples of calculi formed around sutures and other foreign bodies.

John H. Watson<sup>9</sup> surgeon to the Victoria Hospital Burnley in his paper on Ureteral Stone states. There are however certain general facts which may be well worth recalling in these cases. In the first place stone in the ureter is certainly more prevalent than is supposed according to some writers it is of greater frequency than renal calculus. They may arise in the ureter but as a general rule they form in the renal pelvis and then pass into the ureter the etiology is therefore practically that of renal calculus which is still a vexed problem.

Brasch and Moore<sup>6</sup> under the section on treatment state. In the consideration of ureteral stone its renal origin should be borne in mind. Further data from the valuable contribution will be referred to later.

O. S. Fowler<sup>7</sup> of Denver has called attention to the possible importance of stasis in the etiology of stone formation. He attributes the stasis to a kink in the ureter due to prolapse of the kidney as demonstrated by the method he has done so much to develop of taking pyelo uretero grams in the erect posture. Almost all of his recent enograms however reveal ureter which are dilated below the point of kinking as well as above and I would interpret them as being cases of unrecognized ureteral stricture low in the channel causing a dilatation of the ureter and kidney pelvis and a prolapse of the heavy hydronephrotic kidney resulting in apparent kinks in the upper ureter. I have several ureteral stricture cases showing this kidney prolapse and apparent ureteral kinking but they all show the ureteral dilatation down to the stricture area as illustrated strikingly in Figures 1 and 2. Reference to Figure 3 shows a remarkable circular twist of the upper ureter at the ureteropelvic juncture. This patient had a kidney fixation six months before this pyelo ureterogram but continued to suffer with renal colic. Viewing this picture one might say that the renal attacks continued because of faulty fixation of the kidney resulting in this pulveo ureteral twist but

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Fig. 1 To illustrate picture often seen in roentgenography and heretofore interpreted as hydronephrosis due to a ureteral kink. X-ray catheter obstructed in a kink. Note the dilatation below the kink showing that the actual cause of obstruction is lower. The symptom in these cases clears up without fixation of the kidney after the dilatation of the strictures and establishment of free urinary drainage. Fixation of the kidney without dilating the stricture is followed by further vomiting.



Fig. 2 Same patient as illustrated in Fig. 1 the catheter being withdrawn until the wax bulb is located 10 centimeters from the tip of the catheter has obstructed in the upper stricture at the iliac gland region. Note slight dilatation of the ureter between the stricture and the lower stricture in the broad ligament region.

the patient's symptoms were entirely relieved after dilatation of the two strictures in the lower ureter.

Reference to Figure 4 shows a decided displacement and kinking of the right ureter in the appendix region and stasis above which might be interpreted as ureteral obstruction due to an old appendicitis but reference to the legend and report of Case 2 will show that this illustrates the condition found in a patient who was probably suffering with what I have described as simple stricture of the ureter.<sup>1</sup>

While Rossing was one of the early modern writers on ureteral stone I have reserved quotations from him until the last because of his clear manner of stating that ureteral stone may form in a stricture.

He affirms that a stone may arise in the kidney and become obstructed in a narrow portion of the ureter or it may arise primarily in the ureter due to a stasis of the urine by a stricture be it a congenital stricture or valve formation be it the result of tuberculous or other suppuration and ulceration processes.

He takes the position that an infection is present at the same time which results in the deposit of hard urinary particles about the inflammatory organic elements.

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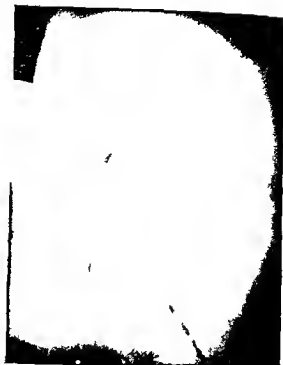


Fig 4 Ureteric stone  
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Of the 16 cases of ureteral stone which he had observed he was ready to assert that but one had certainly had its origin in the ureter itself. This was in the case of a woman who had worn an inhibitory pessary which Foxing considers to have caused pressure on the ureter resulting in a narrowing and inflammation above which the stagnated infected urine could deposit its phosphates around the pus cell and fibrin shreds.

Foxing takes up the consideration of the factor which may hinder a concretum which forms in the kidney and descend into the ureter from passing entirely through the ureter. He mentions a physiological factor the three normally narrow areas in the ureter and the pathological factor he divided into two groups the intra-ureteral and the extra-ureteral.

In the first pathological group belong congenital valve formations or narrowings of the ureter and inflammatory stricture be it of simple or of tuberculous origin. Foxing finds the suggestion in the literature



Fig 5 Ureteric stone  
t h d p l e m t f

that the passage through the ureter of sharp edged concretions may wound the ureter and thus set up stricture formation and constriction for the stoppage of later concretions. He doubted whether any of his cases belonged to this class.

The extra ureteral pathological processes which may cause the arrest of a stone may be tumor formations which compress the ureter or disease of the surrounding tissues. The ureter may be situated in the contracted connective tissues and be compressed by them or it may be retracted laterally to form a kink and consequent blockage of a stone. He considered two of his cases as belonging to this category. One a woman 40 years of age had a severe illness 18 months before her first ureter colic. This he interpreted as being due to a right sided tubal pregnancy resulting in an exudate behind and to the right of the uterus displacing the uterus



Fig 6 Ureteral stricture with hamaturia

toward the right and leading to a sharp kinking of the left ureter in which he demonstrated a stone. In a second case he found



Fig 7 Ureteral stricture with hamaturia



Fig 8 Bilateral stricture and stone in one stricture



Fig. 1. Bladder stone.



Fig. 2. Bladder stone.

pyuria and a finger-sized calculus above the cervical portion of the uterus in a woman who had had puerperal fever with peritonitis attack and had been confined in bed for six months.

*Statement of the author's views.* Except for the one factor of the intermittent gush of urine which tends to sweep any foreign material from the ureteral lumen, a ureteral stricture prevents the ideal condition for the formation of calculus. The strength of the normal gush must be increased in the narrowed stricture area and yet there must be some interruption and eddying of the stream in some way, thus making a degree of stasis favorable to stone formation. Our histologic studies of the stricture area have shown a change in the type of epithelium from the stratified transitional to the squamous and that in some stricture there is actual ulceration. The urinary analysis



Fig. 3. Bladder stone.



Fig. 1. Same patient as Fig. 2 and 3.

shows blood in a fairly large percentage of stricture cases. This blood in some cases is probably due to overdistention and trauma to the kidney pelvis when the stricture swells shut and in other cases it is undoubtedly due to bleeding from the ulcer at the stricture area (see Figures 5, 6 and 7). A slight oozing and coagulation to form a small blood clot at the stricture site would form an ideal nidus for the deposit of urinary salts particularly with the added factor of stasis of the urine.

Without actual ulceration of the stricture mucosa we probably have other factors favoring stone formation such as an excess of a serous or mucoid secretion as found elsewhere in catarrhal conditions of the mucosa, an increase in the desquamation of epithelium and irregularities of the surface to favor the retention of these organic exudates and the deposit of inorganic precipitates.

It is probable that these mechanical theories do not fully account for the formation of stone in the ureter.

If they were all sufficient we would find ureteral stone in a much higher proportion of stricture cases than we do and further

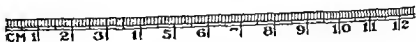
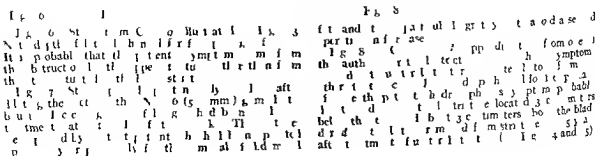
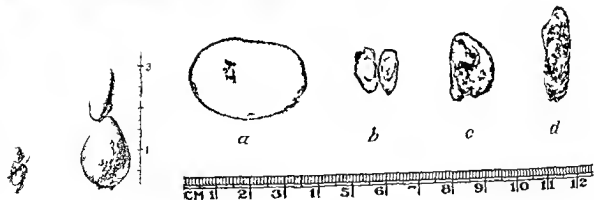
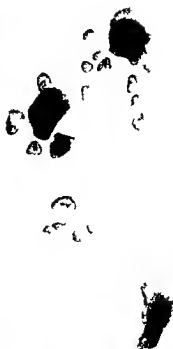


Fig. 3. Illustrates a case with two strictures in the pelvic portion of the left ureter. A stone in the lower stricture obstructing the catheter and shadow of the ureter within the ureter between the two strictures. Recently developed symptoms from bilateral stricture.

more we would expect to find stone in the bladder much more frequently. In many cases of bladder inflammation which come under observation we have the ideal mechanical conditions for stone formation such as ulceration, bleeding, increased exudation of serum and of epithelial cells and a comparative stasis of the urine.

In a very small percentage of bladder ulcers do we find stone formation. It is apparently favored when the urine carries a proteus or some other alkaline producing organism but the bladder ulcer may be covered with urinary salts in the presence of an acid urine and colon bacillus infection. Whenever we find a bladder ulcer covered with fibrinous and mucoid material impregnated with urinary salts we have potential stone formation and it is probably the constant activity of the bladder walls plus the free drainage





through the relatively large urethral canal that determines the breaking off and extrusion of these potential calculi.

Similar factors of peristalsis and force of the urinary stream tend to clear out incipient ureteral calculi but the narrowed channel at the site of the ureteral stricture tends to hold these calculi and determines a much larger number of stones in the ureter as compared with the bladder.

While the presence of an infection probably favors stone formation by intensifying inflammation causing more serous and epithelial exudate and by decomposing the urine and setting free its solid constituents and at times by furnishing clumps of organisms as a nucleus for stone we must admit that we find many stones in the urinary tract unassociated with infection. It might be argued as held by Harris that infection was present and was a factor in the laying down of the stone nucleus and that the infection cleared up later. We believe the presence of a stone in the tract would tend to perpetuate an infection and in many of our stone cases there has been no past history suggesting a pyelitis or a cystitis. It is true that a patient with stone may have had an unrecognized pyelitis or cystitis attack the symptoms of which were not marked and have been forgotten by the patient when she presents herself with evidences of aseptic stone in the tract.

Our conclusions are therefore that ureteral stricture plays a role in stone formation of far greater importance than has been realized heretofore. The majority of ureteral stones probably form within a stricture area. Some of these escape and give rise to bladder stones or are passed. Some stones formed in a stricture area probably escape and float upward and become kidney stones.

While we have in ureteral stricture the ideal conditions for stone formation considered from the mechanical viewpoint we must credit the presence of bacterial infection with a share in the formation of some calculi and it is probable that the chemical or specific diathesis theory cannot be eliminated if we are to account fully for this pathologic phenomenon. We

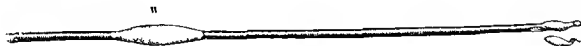
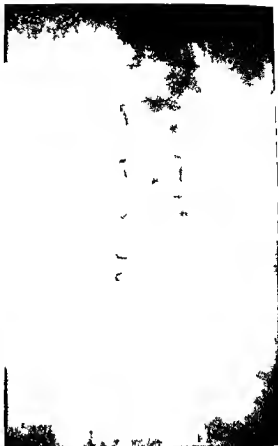


FIG. 19 Uteral stricture case

see an occasional patient who repeatedly passes uric acid calculi from the kidney in whose urine we are not able to detect unusual changes and in whose urinary tract we are unable to demonstrate any abnormality during life. Such cases might be credited to a low grade nephritis but we usually think of this type of stone formation as due to faulty metabolism, obscure biochemical changes or some such poorly understood diathesis.

The formation of the rare fibrinous calculi according to Gage and Beal<sup>1</sup> is probably preceded by a hematuria.

*Clinical observations supporting the view that ureteral stones often arise primarily in a stricture.* The extremely small size of many ureteral stones found encased in dense ureteritis tissue is an argument against the old view that the ureteritis is due to the



irritation of the stone. Such small stones if formed in the kidney would pass entirely through a normal ureter.

The occurrence of bilateral stricture with the presence of a stone only on one side argues for the secondary character of the stone. If the stricture formation were dependent on the irritation of the stone we would expect to find bilateral stone. Five of my cases have shown this condition and three of them are illustrated by Figures 8, 9, 13, and 16.

Multiple stricture in one ureter with a stone in but one stricture area is suggestive of the strictures being primary although one might argue that the stone caused one of these strictures and then passed up or down and set up a second point of irritation and ureteritis. Figures 10, 11, 12, 13, 16, and 18 c illustrate three out of several cases of this kind which have come under my observation.

Case 71 of my ureteral stricture cases was a patient aged 37 years who had suffered for eight years with left renal colic the attacks becoming so severe recently that they required several hypodermics of morphine for their control. The urine was smoky with blood and contained pus and a colon bacillus infection. On passing a catheter prepared with small wax rings at intervals of 5 centimeters for locating the possible ureter stone and with one large wax bulb to dilate the ureter the catheter returned with scratch marks on all the rings within 20 centimeters of the tip. The eye of the catheter contained a particle of stone and the large wax bulb had embedded in its surface about a dozen particles of stone. The patient was completely relieved of her severe colic attacks and subsequently had several dilatations of the stricture urea until her symptoms were relieved. She had the contracted type of pelvis holding but 4 cubic centimeters. Scratch marks were never obtained after the first treatment which seemed to have entirely cleared out the incipient stone formation.

In ureteral stricture Case 13 seen with Dr. Pancoast there was an obstruction in the ureter 6 to 7 centimeters above the

bladder and on two occasions definite scratch marks were obtained on the wax tip and bulb. A tender nodule could be palpated in line with the ureter and on vaginal ureterotomy 7 days after the second ureteral dilatation a dense scar tissue area was opened but no stone was found. Dr. Pancoast then explored and drained the large hydronephrotic kidney and at subsequent dilatations of the patient's stricture area scratch marks were not obtained. It is probable that the patient had either passed her calculus before our operation or the stone was so small that it escaped our notice while we were doing the vaginal ureterotomy or the stone had floated up and after operation escaped through the nephrotomy wound.

The large ureteral stone Figure 18 d was removed from the right broad ligament region in my ureteral stricture Case 9 five years after I had repeatedly dilated strictures in the right broad ligament and iliac gland regions and in the left broad ligament region. Figures 14 and 15 show the condition found in the kidney three years after removing this broad ligament stone and it might be argued that this stone originally formed in the kidney and became lodged in the lower ureter where it took on the ureteral stone form.

A stone having formed in a stricture area may persist for years with comparatively few symptoms due to the fact that the urine tends to channel one side of the stone and keep a free passage (see Figs. 16 and 18 c). Such a channeled stone may shift its position due to a fall or some form of sudden exertion by the patient when the lumen may be blocked and a typical sudden colic supervene. Such a sudden obstruction if unrelieved leads to serious consequences to the already partially damaged kidney and it may lead to reflex anuria and death of the patient particularly if the opposite kidney be below par from the effects of stricture or stone in its ureter or from any other cause.

The sudden shifting of position and consequent blockage may result in such a herd of pressure that the stone is swept out of the ureter and becomes a bladder stone or is passed to the outside. Figures 19 and 5

illustrate cases in which the patients had passed ureteral stone but continued to have symptoms until dilatation of their ureteral stricture. In one of my ureteral stricture cases the patient had suffered with bladder discomfort and incontinence for nine months and I removed a stone 15 millimeter in diameter from the bladder. Six or eight years previously the patient had suffered a severe colic attack on the left side requiring morphine. The X-ray showed in addition to the bladder stone a small shadow in the left broad ligament region and investigation with the wax tip and wax bulb catheter demonstrated this to be a phlebolith but the patient had two strictures in the broad ligament region and a left colon bicillus prolapsus with kidney content of 1 cubic centimeters.

It is likely that the records of a stone taking many years to pass retrograde to a certain point in the ureter before its removal by operation are often records of patients who have suffered for years with ureteral stricture and have more recently developed a stone in the stricture area.

The comparatively frequent ascertainment of kidney stones with ureteral stricture have caused in my list 50 ureteral stricture cases see figure 10 and 11 convince me that some stones forming in a stricture may eventually become released distal upward and become kidney stones. Such stones may remain in the kidney permanently or they may be migratory being found either in the kidney or ureter or they may increase in size while in the kidney pelvis and eventually begin a descent and become blocked in some portion of the ureter above the stricture site or make their way back to the stricture site where they completely block the ureter because of their increased size and lack of lateral urinary channel such as we usually find in those stones which have always remained in the stricture area.

I believe that this peripartetic character of some stones explains some of the problems suggested by Braasch and Moore whose report on the vast experience and accurate observations of the Mayo Clinic furnish us with one of the most valuable chapters on

ureteral stone. In their paper above referred to they state: "The majority of the stones in the pelvic portion were not lodged exactly at the point of narrowing at the ureterovesical juncture but a short distance above it." My work on ureteral stricture has shown that the stricture occurs in the broad ligament region or within 6 centimeters of the bladder in 82 per cent of the cases. By far the greatest proportion of these strictures were at a point 3 to 4 centimeters above the bladder rather than in the ureterovesical juncture.

Braasch and Moore state that of those stones described at the ureteropelvic juncture the majority were found a short distance above the point of narrowing. Contrary to the past literature on ureteral stricture which has considered this lesion of congenital origin and located it at the points of congenital narrowing in the ureter I have shown that stricture in the pelvic brim region does not occur at the ureteropelvic juncture but at the iliac gland region 3 or 4 centimeters below the pelvic brim (17 per cent) some of these stones which Braasch had a short distance above the pelvic brim were probably formed in the kidney and some were probably formed in a ureteral stricture and had traveled back to the kidney where they increased in size and on return to the ureter they were too large to reach the pelvic brim. The same is probably true of the group of which he states: "It is difficult to explain the large number of stones found in the upper third of the ureter." He states:

"The majority of such stones however were of considerable size. He also states: 'The average size found in the lower third of the ureter was much smaller than those found in the upper ureter (these lower stones have always remained in the stricture areas).' Braasch states: 'As a general rule stones situated in the ureter at points other than those of natural narrowing were larger and caused more renal destruction than the others (stones which lack the lateral urinary channel so often found in those stones permanently fixed in a stricture area).'"

*Practical clinical deductions.* This study was undertaken to emphasize the importance

of ureteral stricture as an etiologic factor in the formation of urinary calculus

A few clinical deductions following from this thesis are of such practical importance that it seems appropriate to give them space in this paper devoted to etiology. Ureteral stricture is of such frequent occurrence that every case demonstrated by X ray to have a small stone in the kidney pelvis should have investigation for the presence of ureteral stricture before operation (see Figure 20). In lieu of such pre operative investigation such cases at operation should have a renal catheter carrying a 4 millimeter wax bulb within 3 centimeters of its tip passed through the pyelotomy opening downward into the bladder. Such a wax bulb will serve to detect and dilate an occasional stricture low in the ureter. If a stricture is discovered in this manner drainage should certainly be left down to the pyelotomy wound to take care of possible leakage due to the swelling shut of the stricture area incident to the trauma of its first dilatation.

The returning wax bulb should be investigated for scratch marks for in rare instances an unsuspected ureteral stone will be indicated by this test.

The above instructions apply with equal logic to operations for ureteral stone located above the pelvic brim particularly if the stone is found in a dilated ureter and is not encased in an area of dense infiltration (probably a migrating stone). In operating for a stone in the lower half or pelvic portion of the ureter one will usually find such stone in a stricture area located either a few centimeters below the pelvic brim (ilac gland region) or a few centimeters above the bladder (broad ligament gland region). In view of the comparative frequency of multiple strictures in the pelvic ureter careful investigation should be made for other strictures than the one encasing the stone (Figures 10, 11, 12 and 13). With a well channeled stone it is more than probable that the symptoms are due to the second stricture although one occasionally sees a case with marked symptoms due to a single stricture with a well channeled stone the symptoms probably being due to the stone shifting position.

On finding a stricture area about a stone this should always be thoroughly dilated as a part of the operation. It is preferable when possible to make the ureterotomy opening in the dilated portion of the ureter above the stone and then to grasp the stone with delicate forceps and drag it up through this opening or to milk the stone out of its stricture bed and up to the ureter incision. Unless the stone is large enough to be well outlined in its stricture bed one is likely to have trouble in dislodging it and in such cases it is better to cut directly into the stricture area and on the stone. The dilatation of the stricture must then be carried out in both directions from the ureterotomy opening.

In operating for a fairly large stone in a stricture area one occasionally finds a second smaller stone or a nest of small stones just above or below the large stone. Great care should be taken to prevent these smaller stones from escaping up or down in the ureter to cause future trouble.

With added experience we should get most small stones in the pelvic ureter to pass spontaneously. Figure 17 shows the largest stone I have dislodged by this method. Figure 23 shows the type of gum elastic graduate dilating bougie I am now using with much satisfaction in the later treatments for ureteral stricture and for dilating in the stone cases after using my spiral tip wax bulb catheter (Figure 2) for the early work in testing for scratch marks dilating the stricture getting its location the size of the kidney pelvis lavage culture taking and estimating the renal function. In dilating for stone one should avoid treating too frequently. My experience with ureteral stricture dilatation has shown that it takes from a week to ten days for the edema incident to the trauma of treatment to subside fully. This corresponds with my experience in getting ureteral stones to pass. They usually escape in 8 to 10 days after the last dilatation. Occasionally after the ureter has been previously stretched by repeated and increased caliber dilatations a stone will come down within the first few days of the last treatment.

## CASES SHOWN IN PLATES

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left side and finding scratch marks on the wax bulb and tip the small stone shadow was discovered in the lower end of the left ureter at a point symmetrical with the stricture of the right side. Examination with wax tip bougie 24 days later showed that the stone had been passed.

CASE 8 Mrs. R. age 49 referred by Erasmus Kroman. For 6 years she had had intermittent colic like pains in the left side and back and radiating down course of ureter accompanied by nausea and vomiting. After this plain X-ray demonstration the shadow of a stone apparently located in the upper pelvic portion of the left ureter. Figure 1 was taken. A No. 7 whistle tip catheter was prepared with rings and a large wax bulb and it was successfully passed to the kidney. About 2 ounce of urine escaped rapidly and 75 cubic centimeters of thorium were introduced to the kidney for the X-ray photograph. On withdrawal of the catheter the wax bulb hung definitely in two areas and the wax bulb and the small wax ring within 15 centimeters of the end of the catheter were deeply scratched on one side. The patient continued in her uramic and weakened condition with much nausea and vomiting but had less pain after the passage of the wax bulb until the eighth and ninth days when there was a great increase in pain. We hoped the stone was passing but the patient's condition was so threatening, that we decided to operate (see Fig. 2). On the way to the operating room Figure 3 was taken showing that the stone had left its normal site and had caught in the broad ligament region probably in a stricture area as indicated by the second halves of the wax bulb. McBurney's muscle splitting extraperitoneal incision over the left pelvis the dilated ureters identified at the pelvic brim region and a tube passed under it. At the region of the internal iliac bifurcation there was a definite stricture area but the stone had escaped. The stone was found in the broad ligament region and was easily pushed back to the upper stricture area but could not be brought through this area into the more dilated portion of the ureter above the stricture until we made a ureteral myotomy above the stricture and dilated the Hegar dilator from size 5 to 8. Each dilatation hung definitely at the stricture area. After the dilatation the stone was easily pressed up through the stricture and out of the cystometre incision. A No. 6 Hegar dilator was passed all the way to the bladder to dilate the stricture area in the broad ligament region. The operation was done under hypogastric and asfithedromomycin anesthesia in the meretric hock. The patient had an output of 400 cubic centimeters of bloody urine during the first 4 hours after operation but she felt rally and had no chills. During the second 4 hours she secreted only 300 cubic centimeters and died at noon of that day before perfectly convalescing to the last. This was probably a case of bilateral ureteral stricture in which the ureteric dilatation was too obstructed to carry the patient through after relieving the obstruction on the stone side.

CASE 9 Mrs. McD. age 33 referred by H. A. Fowler of Washington in June 1917. First child born 10 years before onset of symptoms followed by later children. In the left iliac region and then deformed pelvic attack of pain through the left hip region. High left bushard (plaviscin) with uric acid and the presence of a renal calculus. The pain ceased after a hypodermic of morphine and she suffered the calculus had passed. The urine was clear at the time. Within the next year it was she had a mild attack and then it ceased for 6 or 7 years. About 3 years ago she was in bed for 3 weeks with an attack of illness with fever but no pain. The urine then showed blood and pus. Sent to Phila-

delphia after this attack and Dr. Pancoast found two ureteral stones by X-ray. Dr. Keene verified this saying the lower stone was within two inches of the bladder. Dr. Fowler verified these findings and wrote that in the first plate made the two shadows were touching each other. In some later plates the upper shadow had moved upward and was separated considerably from the lower shadow. It would seem that the large upper stone moves up and down in the ureter and is not fixed as the lower one appears to be.

My examination revealed tenderness in both broad ligament regions on palpating the ureter. What seemed to be a small stone was easily palpated about 3 centimeters from the bladder on the left side. Investigation of the right side showed a definite stricture 3 centimeters above the bladder and the reaction from this examination kept the patient ill for a week. Investigation of the left side resulted in obstruction to the X-ray catheter 3 to 4 centimeters above the bladder. An attempt to inject the kidney and upper ureter with thorium resulted in much pain in the lower ureter after 2 to 3 cubic centimeters entered the ureter. Note the upper shadow (thorium) and the small amount of thorium which has run back into the bladder (Fig. 13). Operation revealed but the one small stone wedging the end of the catheter. This was encased in a broad ligament structure and there was a second dense structure at the iliac gland region which had trapped the thorium caused the intense ureteral pain and resulted in the upper large shadow taken to be a second stone. The stone was removed (see Fig. 16). Both structures were well dilated the upper ureter was followed to the kidney pelvis with negative results. X-ray was taken during convalescence with negative results. The patient wrote three months later. I have never been as well in my life and have gained 25 pounds.

CASE 10 The patient first seen March 24 1909 when she was almost exsanguinated from hemorrhage from the right kidney. Nephrotomy March 26 did not cure an acute taphylococcus aureus pyelonephritis kidney and control of bleeding by a square catgut suture tied about a gushing point of hemorrhage situated in the pelvis immediately beneath a papilla in the upper pole. The patient had always suffered with tonsillitis having had an acute attack three weeks before the acute hemorrhage.

Six months later discovery of a stricture in the right ureter one in the broad ligament region and one in the iliac gland region. Right pyelonephritis of 15 cubic centimeters. One year after the operation discovery of two structures in the left ureter and a left hydrocephalus of 30 cubic centimeters with staphylococcus aureus infection. After dilatation of the structures the patient gained in eight months 17 pounds before the operation. The patient appeared to be in excellent health although the feet were pitted. In December 1914 I removed the large ureteral stone (Fig. 18) and made a dilatation of the right ureteral structures. X-ray by Dr. Baetjer on November 27 1910 gave a negative result on either side. On December 20 1917 this patient again had signs of obstruction in the right side. Figure 14 was taken. Catheterization then attempted though the scratch mark indicated the presence of the pelvical catheterization as evidently too small as the patient became comfortable after the examination and her temperature of 103.9 dropped to normal. The osmotic plethysmograph injected into the vein yielded a result of 1.1 in the left side and 1.2 on the right side through the bladder in 8 minutes. 1 from the right side through the catheter in 20 minutes. 1 one half hour the left side secreted 27 per cent and the right side 3 per cent. Later investigation



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## RECURRENT STONE IN THE KIDNEY

B. CHARLES R. POBINS, M.D., ILL. NO. 11001

I f l M d t ll l v s c l l M m l l l l m l 1/2 Ch l v g Hosp l

THE recurrence of a condition for which a surgical operation has been performed is an important matter and merits serious consideration. The publication in 1915 by Cabot and Crabtree (1) of a study of end results in operation for kidney and ureteral stone performed at the Massachusetts General Hospital for a period of eight years previous to January 1, 1914 was somewhat startling. In this it was shown that 40 per cent of the cases suffered from kidney stone and 9 per cent of those suffering from ureteral stone recurred. In 1917 Britsch (2) and W. J. May (3) published a review of 430 cases at the Mayo Clinic operated upon for nephrolithiasis and from a careful analysis of these cases the recurrences were found to be slightly less than 10 per cent. The question of recurrence of stone in the kidney was brought somewhat forcibly to my own attention by having four cases under treatment at the same time. The chance to be the only cases in my practice that have come back but there were doubtless others from which I have not heard. In view of the two very large series referred to above my individual statistics would hardly add much to the subject. However as each of my cases shows a different type of recurrence following a different operation the histories themselves should be of interest.

In dealing with stone in the kidney I have followed Brewer (4) in dividing my cases into two groups, one in which the stone was

apparently the primary condition and the second where the infection of the kidney was apparently the primary and predominant element. In the first case the removal of the stone was the indication in the second the cure of the infection which would usually mean the removal of the kidney as the infection is ordinarily too advanced and the alteration and destruction of the kidney too permanent to hold out much hope of improvement from any form of conservative treatment. Whether this simple classification meets the condition further investigation must prove.

There can be no question about the soundness of the three principles of treatment laid down by Schedt (5) when he states that the object of treatment is in the first place to remove a formed calculus in the second place to limit the injury thereby produced as far as possible and in the third place to protect the patient against a return of the trouble. The first two have been amply met by the refinements of modern technique but the third has apparently received very little attention. Previous to the publication of Cabot and Crabtree's paper there seems to have been no systematic effort to determine whether the trouble returned or not.

It is not the purpose of this paper to enter into an exhaustive discussion of any part of the subject but simply to use the cases reported as a text for comment.

*The cause of formation of stone.* In order to prevent a recurrence it would be necessary

to understand why stones form in the first place Professor Schede (5) described the formation of calculus as it has been usually understood commencing with a nucleus of some sort and the deposit being made in concentric layers. He speaks of an organic framework demonstrated by Lbstein of the investigations of Moritz which showed that this organic framework was present in all urinary crystals but concluded that the quantity of this organic matter may be a factor. He also thinks that the composition of the urine retention geographical situation customs and habits and period of life are important. On the other hand Kelly and Burnam (6) state The essential conditions which lead to stone formation are imperfectly understood. Age sex habits diet—none of these seem to play a great part. The stones which are found in the kidney are composed of substances normally present in the urine. The problem to determine is why these salts are precipitated into stone in some cases and not in others. In reference to nucleus they state It has been suggested again and again that foreign elements in the urine such as bacteria blood clots or shreds of tissue may furnish the nuclei on which stones are built. Numerous cases are on record where bacteria blood clots etc. have been found in the nuclei of stones. Nevertheless such findings are the exception. Barker (7) defines a renal calculus as the formation in the pelvis of the kidney or in the kidney itself of calculi through the deposition of solid substance from the urine usually deposited upon some organic nucleus and in reference to etiology many studies have been undertaken to determine the cause of stone formation in the pelvis of the kidney but the exact pathogenesis is still far from clear.

*The effect of any general treatment directed to the prevention of stone formation.* The treatment advised for lithiasis is well illustrated by the article on this subject in Forchheimer's *Therapeutics* by I. S. Mearns (8) who gives many directions concerning exercise alcohol water and diet and in reference to the latter describes various diets depending on the composition of the stone. This is somewhat confused by the fact that the

majority of stones are of mixed formation and he is then forced to quote Klemperer who says The prophylaxis of renal calculus lies in the mixed diet dictated by nature. I have had no experience in dieting to prevent stone or its recurrence but in one of the cases which I report the patient was directed to drink large quantities of water which he did religiously and notwithstanding this he had two recurrences. It would thus appear that we have at the present time no definite method of combating stone formation.

*The role played by infection.* The case of Mrs. R. C. A. which I report would appear to be one of a long standing infection with secondary stone formation. Infection I believe will have to be considered as very important in considering stone formation and its recurrence. In the thirty cases of stone which were chemically investigated by Dr. G. L. Gordon and reported by Kelly and Burnam (6) it is stated It is equally apparent that in mixed stones the phosphates ultimately predominate. The deposition of phosphates is certainly in the vast majority of cases associated with infection. This is a matter of common observation and is due to the resultant change in the reaction in the urine. It is now generally accepted that infection of the kidney is hematogenous in origin the kidney being one of the organs through which bacteria are excreted. It would appear that the alterations in the kidney as the result of infection may be responsible primarily for certain stone formations and in other cases the presence of a stone may be the predisposing cause of an infection which will be the cause of much of the symptomatology and certainly of the destructive action on the kidneys. Mayo (3) states that the type in which recurrence is most apt to occur is in persons having large and branched stones located in a hopelessly damaged and infected kidney in which a conservative operation has been performed and in cases where it is necessary to conserve the kidney he lays great stress on the method of drainage. This of course is done to overcome infection and prevent pocketing. In one of the cases which I report an attempt was made to conserve the kidney because the functional

test showed that the affected kidney had a good function notwithstanding the presence of stone and infection. This was confirmed by incision and inspection of the kidney cortex at the time of operation. There was no recurrence in the kidney operated on but a prompt recurrence in the kidney of the opposite side.

*The anatomical cause.* Frequent mention is made of the fact that where stones recur they recur in the same location in which they were first found. In one of the cases reported by me there were two recurrences in identical but the same location following two operations.

*Effect of the type of operation.* No improvement can be made on the rule laid down by W. J. Mayo (*1*). Notwithstanding this however on all the cases reported by me showed a prompt recurrence in the opposite kidney after a nephrectomy in the same kidney after a pyelotomy and none in the kidney on which a nephrotomy was done but prompt recurrence in the opposite kidney.

*Recurrence is evidently more frequent than supposed.* This is due to the fact that until recently method of determining recurrence have not been exact and also to the optimism of surgeons who after they have operated on a case are convinced that the patient is entirely well and pay no attention to his complaint. The time has about come now however when a good many of these cases that have been operated on for kidney stone are beginning to come back. It is to be hoped that these cases will be carefully studied to determine why they complain and if the stone has recurred. Cabot and Crabtree have established as the standard of cure a negative physical examination as far as the urinary tract is concerned a urine that is normal on chemical and microscopic examination and a negative X-ray. It would appear to me as has been suggested by Briasch that the presence of blood and pus in the urine may be the evidence of a pyelitis which had never been cured and which may have been the causative factor of the pre-existing stone. It would hardly be fair to count this as an evidence of recurrence.

*Patients may have stone and still be in comparatively good health even where there has*

*been a recurrence.* This is evidenced by two of the cases reported by me. In one where a nephrectomy had been done and a stone had recurred in the opposite side the patient had a large quantity of pus diminished kidney function and some edema and general bad health. She has been treated with various urinary antiseptics and irrigations of the pelvis of the kidney. The kidney function has not markedly improved and pus varies in amount but edema has disappeared and the patient is feeling comparatively well. In the other case a recurrence in the opposite kidney followed a nephrotomy and drainage and was either preceded or followed by a severe infection attended by fever chills and emaciation. This patient gradually improved under treatment carried out partly by myself and partly by her attending physician has gained about 30 pound in weight. She has only slight frequency of urination and suffers no pain or discomfort in the removal of the kidney. She came to see me to tell me that she was entirely well and yet the X-ray plate showed four stones in the kidney.

#### CONCLUSIONS

Notwithstanding all that has been said or can be said the conclusions of Cabot and Crabtree in my opinion are thoroughly sound. I trust that further experience will enable us to improve our results but at the present time this is as far as we can go. They say: On the basis of these cases we can only say to the patient that the risk of operation is small that the danger of progressive destruction of the kidney by the stone if it is left is considerable that it depends somewhat upon the age undoubtedly somewhat upon the method of operation and the skill with which it is carried out but clearly upon an entirely unknown factor—the liability or the ability of that particular kidney to form concretions.

**CASE 1.** Mrs. P. C. A. W. operated upon June 7, 1900 for a right salpingitis and removal of appendix.

About a month after leaving the hospital she had a chill followed by fever and olecranon in left side. Shortly afterwards she passed a stone and had relief of symptoms. In March, 1903, nine months later she complained of pain in her abdomen epigastrium and right shoulder and also



Fig 1 Branched stone in right kidney of Case 1 previous to operation

weakness of bladder. Examination of the urine showed pus and blood in the urine. In November 1908 the urine had become alkaline. In July 1910 she aborted at 3½ months.

At times there was a faintly acid urine reaction and the amount of pus and blood varied. Several X-ray plates were negative for stone. From February 1911 to February 1912 the patient was comparatively comfortable. Catheterization of both ureters in May 1912 showed a few pus cells from the left ureter, a great number from the right



Fig 3 Recurrence of stone in opposite kidney after nephrectomy Case 1

In September 1915 the patient reported a continuation of pain in the back and bladder disturbance and an examination of the urine showed considerable pus and few red cells. Cystoscopic examination showed congestion and edema of the base of the bladder. The flow from the right side was scanty and cloudy in comparison with left. The right side showed pus and colon bacilli, the left side negative. Following this four lavage treatments were given the right kidney. In October 1915 leaded catheters were introduced into both ureters up to the kidney pelvis and an X-ray plate made before and after collargol injections.

X-ray plates showed a normal left kidney and in the right kidney an enormous stone filling the pelvis and projecting into the calyces. Five days later these findings were confirmed by a second X-ray (Fig 1).

In testing the kidney function the phenolsulphonephthalein was injected intravenously and normally should show about 15 per cent in 15 minutes. In this test the right kidney showed only 1 per cent and the left kidney 20 per cent. The destruction of the right kidney substance was well shown in the subsequent operation. Catheterization of the ureters gave the same findings as at the previous examination: right kidney pus and colon bacilli, left kidney negative.

On October 1, 1915 a right nephrectomy was done. The kidney was much enlarged and adherent. The ureter was divided as close to the bladder as possible.

Gross examination showed all functioning structure practically destroyed; the pelvis dilated and full



Fig 2 Right kidney removed from Case 1

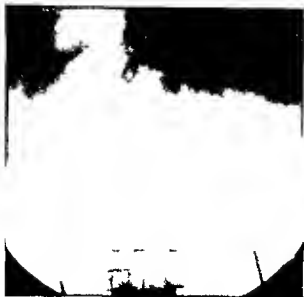


Fig 4 B. Left kidney with large tumor mass.

of pu nd tone. The major portion of the collecting system in the left kidney branches extending to the tip. The tumor is soft and shows a characteristic firm texture. The lining membrane of the pelvis is practically lost and the pelvis is filled with fat. Analysis of the calcium phosphate (Fig 2).

Twenty days later the patient complained of pain in the left kidney and a large amount of pain in the urine. A cystoscopic examination made one week after operation showed the left kidney active but pain was seen coming from the stump of the right ureter. A catheter inserted into the stump was washed out with formaldehyde solution.

Ten days later the left kidney showed necrotic organization of the collecting system and the stump of pus. The stump of the right ureter was still discharging pus. A plug of pus was washed out by irrigating with formaldehyde solution and culture centimeters of pus cells and bacteria.



Fig 5 R. Right kidney with large tumor mass.

In July 1916 the patient complained of a gaging feeling in the left kidney and urine from the bladder held some pus.

In January 1917 the urine contained blood and the patient had a slightly uncomfortable feeling about the bladder but no severe pain.

On February 3, 1917, a cystoscopic examination was made and the stump of the right ureter found obliterated. The left pelvis was dilated the ureter was catheterized and a No. 16 Ga. catheter inserted. The urine contained pus, blood and colon bacilli in abundance.

The next day the X-ray plate showed two stones in left kidney. The recurrence was demonstrated by x-ray four months after nephrectomy of opposite kidney (Fig 3).

The tumor in the kidney has never been removed. The pelvis has been irrigated at intervals with



15 per cent collargol and the patient has been taking various urinary antiseptics. She remains reasonably good health and has very little urinary disturbance. Her kidney function ranges around 50 per cent in two hours.

CASE 2 Mrs I B seen first November 3 1916 at which time she complained of very frequent and burning urination. These symptoms commenced five years ago with an attack of fever pronounced typhoid. She at first had a stinging on urination and later frequent passage of a small amount of urine. After several years she began to have periods in which her symptoms became very much exaggerated and for the past two years she has become steadily worse until now she suffers constantly and is unable to go about or attend to her work. During the day she voids at intervals of from 5 to 10 minutes and is up and down all night. She now has marked tenesmus but otherwise no pain except in itching over the sacral region.

Cystoscopic examination showed a marked inflammation of the base of the bladder particularly associated with the right ureteral orifice the left ureteral orifice was normal in appearance.

Urine collected from the right kidney showed a large amount of pus from the left kidney it was negative. Cultures from the right kidney showed a growth of pure colon bacilli from the left kidney no growth.

X-ray examination showed a branched stone in the right kidney with considerable dilatation of the right pelvis (Fig 4). Capacity right pelvis 20 cubic centimeters left pelvis 10 cubic centimeters.

Function right kidney 10 per cent in 10 minutes left kidney 5 per cent in 20 minutes.

She was operated upon on December 4 1916 and the right kidney was found enlarged and adherent. It was bisected with wire and the stone easily located and removed. The cortex of the kidney was thinned but the parenchyma appeared worth saving. The kidney pelvis was drained with rubber drainage tube. Immediately following the operation the patient developed a temperature which continued irregularly for a period of several months.

On December 28 1916 twenty four days after operation a cystoscopic examination with catheterization of ureters showed as follows: Right kidney (one operated upon) few pus cells no bacteria. Left kidney (previously negative) large amount of pus and colon bacilli. The left kidney pelvis was subsequently irrigated without improvement and in January 1917 an X-ray showed 4 stones in the left kidney. These stones apparently formed in a month's time (Fig 5).

Some interesting points in this case are as follows: On December 2 1916 when the first examinations were made the capacity of the right kidney as tested was 20 cubic centimeters and of the left kidney 10 cubic centimeters and the function of the right kidney 10 per cent in 10 minutes of the left 5 per cent in 20 minutes.

On January 30 1917 a little over 8 weeks later



Fig 5 Horse's kidney. Left pelvis full of material right pelvis empty. Small soft concretions in left ureter about middle. Large stone in right ureter about 4 inches from bladder. Case 3.

the left pelvis had a capacity of 45 cubic centimeters and the left kidney function was 9 per cent in 20 minutes.

The left kidney has not been operated upon. The patient was seen about 10 months ago and had gained about 30 pounds and complained of comparatively little urinary discomfort.

CASE 3 J A G seen first November 5 1916 when he stated that for years he had suffered with pain in the left kidney and marked bladder disturbance. On July 4 1916 he was operated upon at Virginia Hospital and two stones were removed from the left ureter. The X-ray at that time showed no stones on the right side.

He left the hospital in August and after going home had two attacks of kidney colic in the left side and three in the right side and had had constant bladder disturbance and more or less constant pain in the back.

Three weeks before a severe right sided attack he passed three stones and when seen he was in the midst of an attack on the right side.



Fig. 4. Large stone removed from the left kidney.

One of the largest stones in the pelvis of the left kidney. The stone was removed from the right ureter but a small stone in the left kidney and a small sized stone in the bladder.

The stone in the bladder was removed through a cystoscope and a catheter was passed to the point of the stone in the right ureter and removed with crutches. In three subsequent cystoscopies the right ureter dilated the orifice of the ureter with forceps and glycerine injection and the stone in the left ureter was removed. After the bladder symptoms disappeared and the patient had no trouble until December 28, 1906, when he again had an attack of pain in the left side. The patient subsequently suffered with a bad pain in the pit of the stomach and in the left side of the abdomen. An X-ray on February 1, 1907, showed the right kidney, ureter and bladder all clear and in the left side a large stone in the left pelvis which had definitely increased in size (Fig. 6).

On February 10, 1907, through nephrotomy opening a large collection of stone embedded in the graafian material and enclosed in a membrane as removed from the pelvis of left kidney and the kidney pelvis lined. Analysis of stones ammonium magnesium phosphate.

While still in the hospital about three weeks after the operation the patient began to have pain in the right side and finally passed a soft stone.

On March 30, 1907, the right kidney shut down completely though as no lead in the left kidney as excreting freely from the left side of the back. The condition continued and on



Fig. 6. Large stone removed from the left kidney.

April 3, 1907, an X-ray showed the left kidney tract (Fig. 7) but no stone in the left kidney. The stone was removed from the left kidney but a catheter was placed in the right ureter about 4 inches from the bladder which connected to the ureter (Fig. 8). On the same day he was able to cope and a catheter still in the left kidney though the stone was removed. The stone was removed and the stone removed. The stone was removed after the stone was removed.

On April 11, 1907, right nephrotomy was done to relieve blockage of kidney. On May 9, 1907, the patient died and the following was made of the autopsy.

Autopsy line and entire urinary tract on both sides removed (Fig. 9). The kidney and ureters were adherent. The lower pole of the kidney was connected across the vertebral column by a band of renal substance about one and one quarter inches wide and one eighth inch thick making a complete horseshoe shape lying on top of this band. The pelvis and ureters were entirely distinct throughout. The pelvis entered the kidneys anteriorly the bladder supply going behind and laterally. The left pelvis was full of mucohemorrhagic membrane material the right pelvis empty. There was a small soft concretion in the left ureter about the middle. There was a large stone in the right ureter about 4 inches from the bladder. This stone was broken in two places and contained a hole which may have been the point at which the catheter passed through. The stone was no stricture the left ureter. The right ureter was much dilated. The bladder and bladder was inflamed. The entire nephrotomy pelvis in both kidneys. The left kidney was markedly lobulated.

Case 4. H. E. first December 10, 1907, when he stated that four weeks previously he was resting he was ill with a attack of pain in the left side of a bloody urine. From then he gradually improved.

until ten days before entering the hospital he strained himself holding a frightened horse and this caused a recurrence and bloody urine. The pain commenced near the back bone in the loin and ran down to the testicle which retracts. The urine showed blood. The X ray disclosed a small stone in the left ureter just below the kidney pelvis.

On December 9 1911 the stone was removed by a pyelotomy milking the stone back into the kidney pelvis. After this the patient made an uneventful recovery and remained well until November 2 1914 when he complained of a dull throbbing pain in the right iliac region with frequent urination. He had been drinking a large quantity of water by direction.

Examination of the urine showed a few clumps of pus and a few blood cells and amorphous urates.

The cystoscopic examination was negative except that there was blood on both sides which was probably traumatic and a small amount of pus from both sides. The X ray plate was negative.

On July 25 1916 the patient reported that he had had several attacks of pain on the left side and bloody urine. The X ray plate showed a small stone at the exact site of the previous stone and of the same size (Fig 10). On July 31 1916 a pyelotomy was done and stone removed. Analysis of stone magnesium phosphate.

On February 1 1917 the patient complained of a pain in the left side of the back and the urine showed blood. On February 13 1917 a cystoscopic examination was made and an obstruction encountered in the left ureter 25 centimeters from the bladder. A waded tipped catheter showed scratches.

A roentgenogram showed a stone of the same size and in the same location as formerly (Fig 11). The ureter was dilated and glycerine injected twice but so far no stone has passed.

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## THE MANAGEMENT OF SUBPARIETAL INJURIES OF THE KIDNEY

### WITH REPORT OF THREE CASES<sup>1</sup>

By J M MASON MD FACS BIRMINGHAM ALABAMA

**S**UBPARIETAL injuries of the kidney vary much in severity and may consist of contusions lacerations or rupture. The injuries may be simple that is confined to the kidney alone or complicated by injury to the blood vessels ureter peritoneum or other adjacent structures or to any other tissue or structure of the body. As kidney injuries are due to such a variety of traumata the associated lesions are not subject to classification but must be considered individually.

No large collection of kidney injuries is likely to occur in the practice of any one surgeon but the literature contains many isolated case reports numerous small series of cases and several tabulated collections of large numbers of cases with results obtained by various methods of treatment.

For the purpose of this paper it has not been deemed necessary to collect all the reported cases as this has been done repeatedly and the figures have been brought up to date as recently as October 1916 by Bugbee (1).

We prefer to discuss the subject from materials before us modified by more recent advances in surgical technique kidney functioning tests and safer anesthesia.

Hematuria pain and tenderness over the kidney the development of a tumor about the kidney together with varying degrees of shock and collapse following a history of trauma to the loin indicate an injury of gravity to the kidney.

As many cases are recorded where shock and severe pain were absent or delayed we should be carefully on guard when trauma is followed by hematuria and should keep such



a patient perfectly quiet and under constant observation until the nature of the injury is determined.

Expectant treatment, early exploration and late operative treatment have been the plans pursued in dealing with the injury.

*Expectant treatment.* Michelson (1) from Regina Hospital for twenty years preceding 1911 reports 30 cases of rupture of the kidney, all of which were treated expectantly, with only 3 deaths, 10 per cent, and in all the fatal cases there were severe complicating injuries: (a) compound fracture of the leg, fracture of the forearm, multiple fracture of rib; (b) rupture of liver, multiple fracture of rib; (c) fracture of forearm, multiple fracture of rib, pneumonia.

Tomlinson (2) from Municipal Hospital, Oboloff St. Petersburg, 1898-1911 reports 51 cases of ruptured kidney with the following result: Three cases left the hospital untreated and were killed; 15 died as a result of complicating injuries; 43 recovered under expectant treatment; 5 recovered under operative treatment.

From the statistics expectant or non-operative treatment in the uncomplicated case would seem to be without mortality. Watson (4) however reports a mortality of 7 per cent under expectant treatment in 31 collected cases.

The statistics of Michelson and Tomlinson which are widely quoted have given expectant treatment a status which in my judgment it is not entitled to. Furthermore, of the large number of cases reported by them as ruptured kidney, unconfirmed by operation or autopsy, some must have been injury of much less severity.

Concerning the plan of treatment Neilson (5) says: "So-called expectant treatment is permissible only in cases in which local symptoms are insignificant, constitutional symptoms are absent and slight hematuria alone directs attention to the probability of renal injury." He further claims that of this type there are not a few, and to their almost invariable recovery can be given the largest share of credit due to the non-urgent treatment. This opinion seems to me sound and gives to expectant treatment its proper

status. I have not found any pathological studies which tell us exactly what happens to the injured kidney when it bleeds for a few days and stops. Presumably it is contained or a small blood vessel communicating with the pelvis is ruptured.

I except in those cases in which delay is demanded by reason of severe shock or complicating injuries, no just claim can be made in favor of expectant or non-surgical treatment unless it be established that exploration of the injured kidney is inherently dangerous or more dangerous than awaiting development. With our present kidney functional tests, our easy means of demonstrating the presence of a second functioning kidney and our safer methods of urethral catheterization for such inherent or comparative danger cannot be maintained. This is particularly true when we remember that the late development too often are anuria, hemorrhage or sepsis.

That apparent recovery under expectant treatment may be followed by remote chronic illness due to the original renal injury is borne out by three of Bugbee's cases (2).

In Case 4 of his series a tumor of the left kidney with dark colored purulent urine with very little functional activity was found in a patient who received a kick in the side thirteen years previously for which injury he received expectant treatment in a hospital for three weeks. In Case 6 the patient presented symptoms and findings indicative of organized hematoma in the lower pole of left kidney from an injury received four years previously, since which time there had been tenderness with attack of dull aching pain over the left kidney. In Case 8 more or less constant dull pain was present in the right kidney region for eleven years following a fall from a pole which was a contusion with hematoma for four days. There was present a movable right kidney with deficiency in functioning. A pyelogram showed a shadow which was presumed to be a cicatrix from a localized laceration of the kidney. Kelly and Burnham mention that stone formation and tuberculosis have been observed in late sequelae of injured kidneys treated expectantly.



Fig 1 Kidney removed from Case 3

*Early exploration* All operations upon injured kidneys must be in the nature of explorations as it is impossible without inspection to tell the extent or character of the injury which the kidney has sustained. With early exploration conservative treatment of the injured organ may be successfully carried out in a large number of cases in which it would probably fail if attempted later.

In a certain number of instances the lacerated or ruptured kidney may be treated by suture with entire success. This is the ideal method in suitable cases but obviously it cannot be carried out in late operations when necrosis and infection have been added to the original injury.

Watson (4) has collected 10 cases of suture of the ruptured kidney without fatality. Connell (6) has added 3 personal cases successfully sutured and has collected 16 cases without a death and with only 3 failures, one case requiring secondary nephrectomy and one being followed by a urinary fistula. Connell's cases were operated on early, one on the morning of the second day, one on the



Fig 2 Extensive necrotic areas which dip down deeply into the kidney substance some distance below the line of rupture

afternoon of the day following the injury, and one thirty-six hours after the receipt of the injury. A fourth case of rupture operated on on the tenth day required nephrectomy on account of infection and gangrene.

Packing and drainage of the ruptured kidney has shown a very favorable mortality. In Watson's series 107 cases were so treated with a mortality of 8.5 per cent as compared with 132 nephrectomies with a mortality of 25 per cent.

In cases treated by packing the convalescence is prolonged, the final outcome is always in doubt and the patient is in constant danger from secondary hemorrhage. One of Neilson's cases died from secondary hemorrhage on the thirteenth day after operation upon removal of the last of the gauze pack. These drawbacks act as a bar to too great conservatism in dealing with an extensively lacerated kidney unless the remaining organ is distinctly incompetent.

The mortality of 25 per cent for nephrectomy as set down by Watson in 1903 is perhaps much higher than obtains at the present time or should obtain in the future.

This mortality is dependent upon the general condition of the patient upon the competency of the remaining kidney and upon the character of the anesthetic. Unfortunately accidents befall the vigorous and



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d l m p l t

healthy as well as those with organic disease hence a certain mortality will always obtain.

With proper investigation of the condition of the remaining kidney with due regard to the general condition of the patient and with the use of nitrous oxide oxygen anesthesia few fatalities should result.

That removal of the ruptured kidney is not unduly hazardous is attested by the large number of successful cases in which the above precaution have been taken. For example Gibson (4) reports 4 successful cases in children. Boland (5) reports 4 successful cases. My own case here reported recovered. Connell's case was successful as were also large numbers of similar cases on record.

**Late operation.** It is often the case that surgical diseases and injuries do not reach the surgeon until expert treatment has been tried and failed. In the case of the damaged kidney this means that the local and constitutional symptoms have become aggravated and that the patient reaches the operating room in worse condition than if he had been subjected to early exploration. Late operation in the presence of a ruptured kidney usually means nephrectomy, though packing for control of hemorrhage and prolonged drainage for the relief of sepsis will sometimes prove successful.

## SUMMARY

Taking into consideration the high mortality and general uncertainty of expectant treatment and the obvious limitation of conservatism in late operations early exploration is the proper and logical method of proceeding and its advantages may be summarized as follows:

1 The danger of exploration in properly managed cases is slight and is not to be compared to the risks of delay.

The nature and extent of the injury may be definitely and promptly determined.

3 Appropriate measures may be promptly employed for the control of hemorrhage to guard against infection and to provide for drainage.

4 In certain favorable cases suture of the ruptured kidney may be successfully carried out while in other instances the kidney may be saved by packing and drainage.

5 A hopelessly damaged kidney may be promptly removed thereby shortening convalescence and restoring the patient to health in the briefest possible time.

## REPORT OF CASES

Three cases of subperitoneal injury to the kidney have come under my observation two of them in my own practice and one in the care of my associate B. S. Lester with whom I saw the case in consultation.

Two of the cases were ruptures and one I have classified as a contusion or slight laceration of the kidney complicated by fracture of the right iliac crest fracture of the left femoral neck and multiple fracture of ribs.

**CASE 1.** White male age 35 fell from a pole a distance of about twenty-five feet and was brought to the hospital suffering from severe shock. Examination showed that he had sustained a fracture of the neck of the left femur a fracture of the right iliac crest and a fracture of several ribs on the right. He was catheterized and a small amount of bloody urine was withdrawn from the bladder. After he had received some heat from shock in order to determine the source of the bloody urine he was anesthetized with nitrous oxide and cystoscoped. The bloody urine was found to come from the right kidney while the left was found to be functioning normally. On account of the extent of the complicating injuries exploration of the kidney could not be safely undertaken. For four days the urine was very scant and bloody but after that time the

amount became normal the blood cleared up and the kidney gave no further evidence of injury. No tumor developed in the loin and I have classed the case as one of contusion or slight laceration.

CASE 2. Rupture of right kidney, death without operation at end of twenty hours.

This case was seen in consultation with B. S. Lester, who has permitted me to include it with my own. A white man, age about 30, jumped from a moving train about 6 p. m. and fell, injuring his right loin. He made his way home but called the physician about 9 o'clock. He was not suffering severely but had passed some bloody urine. He was with difficulty persuaded to go to the hospital. The following morning the blood having continued in the urine and a tumor having appeared in the right loin and his general condition having become worse, rupture of the right kidney was suspected and he was cystoscoped for the purpose of determining the source of the blood and the condition of the other kidney. The right kidney was found to be bleeding while the left was functioning normally. The diagnosis of rupture of the right kidney was made and arrangements were made for operation. Before these could be perfected the patient became collapsed and pulseless and died before any operation could be undertaken.

CASE 3. White female, age 24, was run over by an automobile on August 16, 1917. According to the history she was severely shocked and suffered from nausea and vomiting. She had great soreness in the left side of the abdomen, especially over the left kidney. Hematuria was present for three days, subsided for 1 day and then returned. She was admitted to St. Vincent's Hospital on August 21, six days after the receipt of the injury, where I first saw her.

Examination showed a temperature of 100 pulse 110, 1 palpable mass in the region of the left kidney, which was extremely tender, leucocyte count of 9250 and bloody urine.

The following morning she was prepared for exploration. After anesthetizing with nitrous oxide

a cystoscope was introduced and the separated unnes collected. The left was bloody while that from the right was perfectly normal. Time did not permit the employment of functional tests. The diagnosis of rupture of the left kidney was made and the kidney quickly exposed.

It was found deeply lacerated and surrounded by a large clot. This completely separated the kidney from its fatty capsule. The clot was lifted out, the kidney was inspected and considered to be irreparably damaged and was removed. One cigarette drain was used and an uneventful recovery followed. She left the hospital with wound completely healed on the nineteenth day.

Reference to the three photographs which illustrate this paper taken from Case 3, which was operated on on the seventh day after injury, show the futility of suture of the kidney after the lapse of any material length of time. Figure 1 shows the gross tearing to which the kidney was subjected. Figure 2 shows the extensive necrotic areas which dip down into the kidney substance some distance below the line of rupture. Figure 3 shows the distinct line of demarcation between the healthy kidney tubules and the areas of complete necrosis.

It is quite apparent that for kidney suture to be successful it must follow quickly upon the receipt of the rupture, before these necrotic changes have taken place.

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## THE MEDICAL PROFESSION AND THE GREAT WAR<sup>1</sup>

By WILLIAM D. HAGGARD, M.D., F.A.C.S., NASHVILLE, TENNESSEE.

M. J. M. D. IR. N. C. P. S.

THE Southern Surgical Association, the presidency of which your exceeding generosity most graciously conferred upon me, has for nearly a third of a century been intensely and diligently seeking to perfect methods and men in the science and art of surgery.

Each year we have come together with gladness and joy, enthusiastic in the achievements of the hour and intent upon the advancement of our professional ability to relieve our fellow beings of their pain and disease. Since last we met the alarms of war have been sounded. Our great nation has

joined the embattled legions of our Allies overseas in self immolation for the preservation of the peace and liberties of the world. The impulses of our protestion have been kindled our responsibilities and problems have been inconceivably augmented. Some millions of our brave and best beloved are consecrating their lives to the stupendous task of making the world free. They will be exposed to the inevitable diseases and mutilations which it will be our duty to prevent to avenge and repair.

The world is bathed in blood and tears. Its peace has been levitated and destroyed with the pitiless and terror of an Alpine glacier.

The war which between the ideal of democracy and utopia. We now know that it was inevitable. The issue is between two political and civil principles which cannot longer dwell together on the earth. Our enemies believe that might makes right, we believe that right makes might. It takes first rank with the most magnificent event in all history. It will not change maps but individual. It will make them free. It is portentous, it is almost sacred in its intent. When the end has been attained it will lift a mighty people upon a higher plane for their development, the great nation thrice pinophed that now faces the world. It knows not that the stupendous struggle for their liberty and for that of all the nations on the globe. It is for this that we are ending our brothers our own and ourselves to take our stand in this gigantic issue upon the outcome of which the future of all mankind will depend.

Commercial Germany would have made a peaceful conquest of the world but industrial Germany had no voice. Imperialistic Germany cunningly planned the most unpardonable and deliberately cruel of all wars. They would none of arbitrament. A Van Dyke said: The Barabbas of war was preferred to the Christ of righteous judgment. Those who loved peace were forced to fight for it or give it up forever.

We must play our appointed part in the world, consecrate ourselves to our principles and policies, put aside self seeking distraction

and the very peace which we have imagined for ourselves in order to give it unto others. The page on which the history of the most holy of wars will yet be written will be illumined with the great white light of our pure and unstained desire to benefit the cause of humanity.

Was there ever a war before where the victor desired no spoils? Should the lofty disinterestedness of our cause and the superiority of our might give us the victory there would be no vindictiveness or economic vengeance wreaked upon our enemies. Our loftiest aims and most sacred ideals have been crystallized and formulated by that rarest of all things that incomparable patriot and immortal statesman Woodrow Wilson Prime Minister of the World.

If our nation lives up to its own plighted word it will gain for itself new honor and imperishable fame. If our sacrifice establishes on a basis and cures those great institutions and opportunities which make man free then the contest rises to the sublime.

Our enemies are not willing to be responsible for this war. Although inaugurating it they disavow their initiative and summon their scientists and philosopher to prove it.

It is not the Teuton or the Oriental who is the enemy of civilization. Militarism is the enemy. From the Straits of Dover to the very gates of the Garden of Eden itself man waged war has run its bloody head.

It is into this hell of iron that the youth and flower of American manhood must first itself. They must join in the comradeship of arms and the exaltation of spirit with their intrepid and fearless British cousins and with the heroes of clear eyed France torch bearer of the nations.

It was of a poet that Henri Barbusse wrote:

Each one knows that he is going to take his head his chest his belly his whole body all naked up to the rifles pointed forward to the shells to the bomb piled and ready and above all to the methodical and almost infallible machine guns to all that wait for him yonder and is now so frightfully silent before he reaches the other soldiers that he must kill. They are not careless of

their lives like brigands nor blinded by passion like savages. It is in full consciousness as in full health and full strength that they are massed there to hurl themselves once more into that sort of madman's part imposed on all men by the madness of the human race.

It was a manly young fellow like one of these who when brought mutilated to the dressing station by the stretcher bearers said 'I offered France my life and she took only my arms.' A young English soldier mortally wounded was seen suddenly to leap into the air and with his last breath cry out 'Are we downhearted? No!'

Are the best physicians and surgeons of our country too skillful or too gentle to be permitted to minister to the fine fortitude of such splendid bravery? No the faithful sons of Esculapius have never faltered! As Sir Berkeley Moynihan has said 'We are as a profession by intellectual descent and by solemn adoption the heirs of the men who have made our race great and famous.'

It will always be an inspiration to us to remember that the first American to carry the Stars and Stripes to our stricken Allies after the fatal April 6, 1917, was a surgeon bearing also a Red Cross, a member of this Association, Major George W. Crile.

It is a honour to our profession that the first officer in the uniform of our country to yield up his life was also a physician, Lieutenant Fitzpatrick, who was struck by a shell that exploded while he was standing in the door of the Washington University Base Hospital.

The personal and material sacrifices which our guild have made and are making are not equaled by any other profession or class. We rejoice in its contemplation and take inspiration from the fact that only through the efforts of the medical profession has the prosecution of the war been possible. It would as our distinguished fellow C. H. Mayo has said have been terminated long ago through the same causes which have terminated all wars in the past through disease and infection.

In the momentous hours of history some individual with transcendent attributes seems to be raised up. The essential to preserving an effective fighting force is primarily vigorous

and immaculate sanitation, scientific and uncompromising prophylaxis. Who could have been more opportunely fitted for this task than the man who conquered the deadly and pestilential Canal Zone—the brilliant Southern scientist and knightly soldier Surgeon General William C. Gorgas? He has summoned about him many score of our best sanitarians, surgeons, internists and specialists who have unstintingly given of their time, knowledge and labor. He has sent nearly two thousand medical officers to our needy Allies. He has builded equipped and manned hospitals from 500 to 1000 beds each in nearly one half hundred cantonments and camps caring for cities of from twenty to seventy five thousand soldiers. He has organized courses of intensive special training in the great centers for his medical officers that in addition to the training camps for the Reserve Corps have become the greatest and most comprehensive post graduate courses in the world. He has dispatched base hospitals not only for our own expeditionary forces but out of his abundance has loaned to the other nations and yet the manifold activities of the Surgeon General's office while innumerable have only begun.

The distressful epidemics that ravaged our armies in the Spanish American War were deadlier to our soldiers than all the bullets fired in the Antilles. Preventive medicine especially as applied to armies has made tremendous progress. Witness our unparalleled feat of mobilizing last year on the Mexican border more soldiers than have bivouacked since the Civil War, more men than belonged to any one command during that sad conflict, more men than were enlisted against Spain and instead of marking the border with lines of tombstones we brought back the 100,000 national guardsmen with a net gain of over a million pounds. There was scarcely a case of typhoid fever and the usual infectious diseases were banished as if by magic. At Chickamauga in 1898 there were thousands of cases. During the three years of the present war the British with her millions of men engaged have only lost 92 men from typhoid fever.

Typhus fever has been denied access to the

battleground of the far flung Western front We will see to it that it will never gain a foothold in our army camps

Tetanus is almost completely prevented So far as lock jaw is concerned the bullet is as harmless as the sting of a bee And now from the Pockefeller Institute comes another discovery an antitoxin for the gas bacillus—by Dr Carrol W Bull You will honor him as a Southerner and I will acclaim him as a Tennessean

The Medical Reserve Corps now numbers nearly fifteen thousand physicians who have volunteered and been commissioned This very remarkable mobilization in eight months of over one sixth of the active practitioners in this country has been made possible by the far seeing and highly proficient labors of the medical section of the Council of National Defense It is due to the patriotism and superlative organizing capacity of one of our Fellows Franklin H Martin who associated with him all another of our fellows Frank F Simpson and these two with indefatigable effort beginning nearly a year before war was declared organized every state and rendered physicians available and effective This is the first time our profession has been given its due meed of recognition in being honored by representation on the Advisory Commission of the Cabinet a recognition long merited and signified by an appointment most felicitous

Through the further elaborate activities of the Medical Section of the Council of National Defense and the far reaching organization of the American Medical Association most elaborate plans have just been perfected by the creation in each state of medical advisory boards to re examine certain registrants in the re classification of nine million men which is now beginning It is not too much to say that the physicians and surgeons were perhaps better organized and mobilized than any other newly created fasciculus of our great structure of preparedness

Through the endeavors of medical men sanitation has become so perfected that the only danger to the soldier is the bullet and if he is not killed outright the superior methods of treating war wounds deprive them of many of their dangers The excellent work

of Carrel and Dakin in putting antiseptic management of war and industrial wounds on a higher and more wonderful plane of usefulness is a contribution to humanity of stupendous moment

If medical men have been of indispensable value in this war who will compute the improvement in the management of every type of injury to the human body? Dr Crile declares that more progress has been made in the surgery of the chest and abdomen in the treatment of wounds of infections of hemorrhage and exhaustion more knowledge has been accumulated of splint of apparatus and of every applicable mechanism in the three brief years of war than in the past generation

Apart from the humanitarian aspects of the war it will be regarded in the eyes of future generations in its end result as has been said as *The War Beautiful* The French Revolution with all its terrors quadrupled the scope of civilization the American Revolution with all its sufferings was of all wars the most constructive the Civil War with its bitterness cannot now be but looked upon as essential and evolutionary One cannot be unmindful of the millions of lives already sacrificed nor of thrice these millions who have been wounded and maimed In comparison we must consider the lives sacrificed in peace by preventable disease by unnecessary industrial accidents and deaths by enforced poverty by the evils of alcohol by prostitution and by wanton manslaughter If as the result of the supreme and essential sacrifices of this war we necessarily or voluntarily safeguard human life—men women mothers and little children—the saving will exceed the waste

Already this war has emancipated men from the slavery of alcohol—the greatest curse and blight upon humanity The gain in food products will be incalculable The tillage of the soil will be raised to the nth power which will make for homebuilding National safety will oblige essential reforms of our tereement system our slums of capital that it should not get more than a reasonable and just profit of labor that it receive its full and fair reward It will insure equal opportunities for women it will signal the end of fabulous

fortunes. The wealthy classes will be quickened into keener appreciation of citizenship. Statesmen will be recruited from men of parts instead of from politicians. In lieu of luxurious indulgence abstemiousness will be the fashion. The creed of physical fitness will be embraced. Universal military training will probably become effective for physical reasons if not for martial needs.

The social disease which has heretofore been considered the inevitable pestilence of armies is being fought with every imaginable agency—education, recreation, diversion, protection, isolation, prophylaxis, penalties, and court martial. Many thousands of young men will for the first time on a wholesale plan be taught the whole truth by all sorts of real men, and purity made a cult, a win the war asset. After the war the idea will permeate all strata of society and be a real understandable and livable benefaction.

It will disseminate throughout America the practice of personal hygiene by uncounted numbers of young men. The beneficent results to accrue to us and to posterity will almost make the war worth while.

When our soldiers reach France it seems that they become exalted with the purpose of victory, they have lived the clean life and believe in it, they have been known to avoid all temptations in the great cities during furloughs. It is army experience that a sober man seldom seeks impure associations. Our American youth will learn reverence for authority, discipline, obedience—immediate and implicit. For the duration of the war the intensive high minded instruction that will be inculcated into the minds and lives of young Americans will work a veritable physical and moral rebirth of this nation.

As the by products of industry are the most important so the fierce necessities of war make many collateral advancements. Great progress in many branches of manufacture has been brought about. We will of necessity make our own dyes and our own chemicals of all sorts.

To effectively educate five hundred million people in the brotherhood of mankind could not have been accomplished without the lessons and results of this war, costly as it is.

When the carnage has ended the world will have drained itself well nigh dry. Much of its best and most precious blood will be spilled. Its liquid capital will have been used up. It will be the privilege of this nation to bind up the war's wounds and to slake the white heat of hatred to be in the vanguard in the colossal work of reconstruction and of rehabilitation. Enormous problems will present themselves when our army disbands. Years will be consumed in demobilization. Restoration of our soldiers to the pursuits of peace in an equitable manner will be a nation broad duty. The conduct of even so gigantic a war as this is comparatively simple to the colossal task of making the world over again when it shall have ended. But the re education of the crippled, the maimed, the sightless and the salvaged after the war is a voyage across uncharted seas into another world. No longer will we attempt to salve the wounds of heroism with alms, or allow a mutilated patriot to eke out a pitiful existence as best he may, rather will it be our splendid aim to re educate that unfortunate so as to give him a trade, or a profession more lucrative, more independent and ennobling than he had before.

For nearly a century and a half our nation has wrought into prominence those principles both of government and of right for which the philosophers have dreamed since the Renaissance. Our federation of states is now the greatest, the wealthiest and the most powerful exemplar of democratic institutions in Christendom. It has been shown that the only way to make the world safe and secure is to entrust it to accredited representatives of the people and not to confide it to dynasties or diplomats, however great.

This is a war for the creation of a new international world, a war for a new international world. Human liberty, justice and the honorable conduct of an orderly and a humane society are the ideals of life which must prevail.

A combination of events has forced the United States into the position of leadership. We have demonstrated that race antagonisms tend to die away and disappear under the influence of liberal and enlightened political



institutions Consider our large Babel tongued population all living in peace and harmony as years pass they are melted in the crucible of democracy and are molded into Americans with all the strength and freshness of a nascent recreation Our democratic institutions have shown their ability to amalgamate and to emancipate every type of human being which has thus far come under our flag It is the alchemy of the nations Why should not each nation in Europe establish for itself a place in the sun of unity which may come when the war clouds have been swept away Who knows but coming out of this dread conflict in which the civilized world has been plunged will issue as Nicholas Butler Murray has said the United States of Europe!

In the end each of the nations of the earth will deposit in a world's federation some portion of its sovereignty for the perpetuation of peace and the furtherance of good will to all

It has been touching to see in this country the spirit of generosity of sympathy for the afflicted the distressed and the stricken in the uttermost parts of the world Although denounced as get rich traders the American people have been lavish with their millions and have given their lives and their endeavor to carry food clothing and succor to the starving Belgians and the other decimated

nations of bleeding Europe We have played the Good Samaritan on a huge scale Never in all history has there been such a generous outpouring of tenderness to those who needed help irrespective of race station or belief

In this beneficent work the representatives of the healing art have had their share As for the Southern Surgical Association—to its lasting honor—your President wishes to record that out of two hundred members fifty of whom are disqualified by age or obvious disability seventy have given their services to their country They are soldiers brave and fearless yet they are gentle and harmless as doves That great anatomist physician and author Oliver Wendell Holmes has beautifully said of our ministrations

A l l e d l m p o  
T m h l d h t e  
A d d t h u b l k b t

O m l to the d m b e t o l l  
T h d m t h d l b a y  
A d b o t r m s o n l l—  
O g l r y t l y

T h t m h l by the t m  
W t h d y t t h f l y  
C l m t l t t p l t g l m  
F l t l k t h l d d k

A t l t b h u  
A b l d d l  
l t b a b t h g l l n —  
O g l y t

## THE TREATMENT OF CERTAIN FORMS OF SUBACUTE PANCREATITIS<sup>1</sup>

By STEPHEN H. WATTS, M.D., F.A.C.S., UNIVERSITY OF CALIFORNIA  
P a t i e n t s r e v i e w e d

I BELIEVE all surgeons are agreed that those cases of subacute pancreatitis in which there is abscess formation should be operated upon and drained the abscess often being indicated by a palpable mass in the pancreatic region sometimes filling the lesser peritoneal cavity and even bulging the abdominal wall but I believe little attention has been directed to those cases of subacute pancreatitis in which the symptoms at the time of operation are not very acute a

diagnosis of gall stone is made and at operation the pancreas is found to be thickened and indurated but still fairly well defined

In these cases there is little or no free fluid in the abdominal cavity and this not blood stained attention being attracted to the pancreas only by the finding of disseminated fat necroses in the omental fat or in the peripancreatic tissues

In previous papers I have emphasized the importance of early incision and drainage of

R d b t t h S h S I A o c

S t A t D e c m b 3

the pancreas itself in cases of acute pancreatitis and have reported four such cases in three of which recovery followed drainage of the pancreas in the remaining case which was a fulminant one the pancreas was not drained and the patient died. However I believe there would have been a fatal result in this case under any conditions. In the light of certain cases which I will presently report I believe that the same thing should be done on those cases of subacute pancreatitis which seem to verge almost on the chronic. In fact I am inclined to believe that some of these represent an acute exacerbation of a chronic pancreatitis. I have operated upon three cases which seem to belong in this category. In all of these cases a diagnosis of gall stones was made. Gall stones were found in the gall bladder and a cholecystostomy was done but the pancreas and peripancreatic tissues were not drained. In all of the cases fat necroses were found in the omental fat or in the fat about the pancreas and the pancreas itself was somewhat in fact in one case markedly thickened and indurated but the outline of the pancreas was fairly well defined. The condition except for the fat necroses suggested a chronic pancreatitis therefore the organ was not drained. One of these cases recovered and was in good condition when seen a year after the operation. The other two died the one nine the other sixteen days after the operation. Autopsies revealed extensive necroses of the head of the pancreas in both cases and in one there was extensive hemorrhage in the tissues about the pancreas.

I believe that if pancreatic drainage had been instituted in these cases the result might have been different. The case reports follow.

**CASE 1** Mrs W. M. age 36 was admitted to the hospital April 14 1911 complaining of pain in the abdomen radiating to the back.

Family history unimportant.

Personal history. The patient has had measles mumps and whooping cough. She had typhoid fever ten years ago. She has suffered with stomach trouble for eight years manifested by vomiting and pain in the stomach radiating to the back. She had nine children the youngest being one month old.

**Present illness** The patient gave birth to a child four weeks ago. Before the birth of the child she suffered from burning cramp like pains in the stomach passing to the right shoulder and these pains have become worse and continued to the present time. They have required frequent hypodermics of morphia. Six days ago she vomited a large amount of bile stained material. At that time she was jaundiced. She had chills every night for a week after the birth of the child.

**Examination** The patient is a thin woman and looks sick. The sclerotics are distinctly bile stained. The pulse is of fair quality 90 to the minute. The temperature was 100 on admission. Leucocytes 9000. Coagulation time four minutes. Urine analysis negative. The abdomen is flat and slightly asymmetrical there being a fullness in the right hypochondrium. On palpation there is considerable tenderness in the epigastrium and right hypochondrium. No mass can be felt in the epigastrium but in the right upper quadrant the edge of the liver can be felt 5 centimeters below the costal margin and beneath this a rounded body the size of a hen's egg which feels like a distended gall bladder. On inspiration it descends almost to the level of the umbilicus.

**Operation** An incision was made through the upper portion of the right rectus muscle. The gall bladder was found to be considerably distended and numerous stones could be felt in it. The gall bladder was aspirated and a large amount of bile obtained which would seem to indicate an obstruction of the common duct rather than of the cystic duct. The gall bladder was then opened and numerous small faceted stones and one stone the size of a walnut removed. A careful examination of the common duct failed to reveal any stones. The pancreas was examined and the whole organ found to be greatly enlarged and fairly fixed in position. In places the limits of the gland were not well defined. In the transverse mesocolon near the pancreas there were several areas of fat necrosis suggesting a subacute pancreatitis.

A large rubber tube was sutured in the gall bladder and the abdominal wound partly closed.

**Postoperative course** The patient did fairly well for a few days after the operation then began to run a temperature and the pulse became more rapid. She died rather suddenly nine days after the operation.

**Autopsy** About a liter of blood was found in the abdominal cavity. The mesentery of the ascending colon was infiltrated with blood. The head of the pancreas was converted into a necrotic hemorrhagic mass. Numerous fat necroses were found. The pancreatic ducts were patent but a firm calculus 5 millimeters in diameter was found in the ampulla of Vater.

**CASE 2** Mrs J. A. H. age 48 entered the hospital February 17 1916 complaining of stomach trouble.

Family history unimportant.

institutions. Consider our large Babel-tongued population all living in peace and harmony as years pass they are melted in the crucible of democracy and are molded into Americans with all the strength and freshness of a nascent recreation. Our democratic institutions have shown their ability to amalgamate and to emancipate every type of human being which has thus far come under our flag. It is the alchemy of the nations. Why should not each nation in Europe establish for itself a place in the sun of unity which may come when the war clouds have been swept away. Who knows but coming out of this dread conflict in which the civilized world has been plunged will issue as Nicholas Butler Murray has said the United States of Europe!

In the end each of the nations of the earth will deposit in a world's federation some portion of its sovereignty for the perpetuation of peace and the furtherance of good will to all.

It has been touching to see in this country the spirit of generosity of sympathy for the afflicted, the distressed and the stricken in the uttermost parts of the world. Although denounced is get rich traders, the American people have been lavish with their millions and have given their lives and their endeavors to carry food, clothing and succor to the starving Belgians and the other desecrated

nations of bleeding Europe. We have played the Good Samaritan on a huge scale. Never in all history has there been such a generous outpouring of tenderness to those who needed help irrespective of race, station or belief.

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Alf s ne d g e t m pou  
T m shal dh ts e en  
T m s n th tr mpled h es  
A d de th sl s bl ch b t e

On m rche t th drum b at ll  
The de mouth d l on b y  
And b rs upon t crim o c ll—  
O r gl ry t sl y

Tl th matches le e by th t m  
With d y t tch l yes  
Calm sth t t t l ts gle m  
Flat fls the l ud d sh

Al it front n sal hu  
N bl o l r d pen  
It b n b r sth l l —  
Our gl y ist a e

## THE TRIUMPHANT OF CERTAIN FORMS OF SUBACUTE PANCREATITIS

B STEPHEN H WATTS M D I A C S UNIVERSITY VIRGINIA  
P resso f S y L y l v

**I**LLUVE all surgeons are agreed that those cases of subacute pancreatitis in which there is abscess formation should be operated upon and drained the abscess often being indicated by a palpable mass in the pancreatic region sometimes filling the lesser peritoneal cavity and even bulging the abdominal wall but I believe little attention has been directed to those cases of subacute pancreatitis in which the symptoms at the time of operation are not very acute a

diagnosis of gall stones is made and at operation the pancreas is found to be thickened and indurated but still fairly well defined.

In these cases there is little or no free fluid in the abdominal cavity and this not blood stained attention being attracted to the pancreas only by the finding of disseminated fat necroses in the omental fat or in the peripancreatic tissues.

In previous papers I have emphasized the importance of early incision and drainage of

the pancreas itself in cases of acute pancreatitis and have reported four such cases in three of which recovery followed drainage of the pancreas in the remaining case which was a fulminant one the pancreas was not drained and the patient died. However I believe there would have been a fatal result in this case under any conditions. In the light of certain cases which I will presently report I believe that the same thing should be done on those cases of subacute pancreatitis which seem to verge almost on the chronic in fact I am inclined to believe that some of these represent an acute exacerbation of a chronic pancreatitis. I have operated upon three cases which seem to belong in this category. In all of these cases a diagnosis of gall stones was made, gall stones were found in the gall bladder and a cholecystostomy was done but the pancreas and peripancreatic tissues were not drained. In all of the cases fat necroses were found in the omental fat or in the fat about the pancreas and the pancreas itself was somewhat in fact in one case markedly thickened and indurated but the outline of the pancreas was fairly well defined. The condition except for the fat necroses suggested a chronic pancreatitis therefore the organ was not drained. One of these cases recovered and was in good condition when seen a year after the operation. The other two died the one nine the other sixteen days after the operation. Autopsies revealed extensive necroses of the head of the pancreas in both cases and in one there was extensive hæmorrhage in the tissues about the pancreas.

I believe that if pancreatic drainage had been instituted in these cases the result might have been different. The case reports follow.

**CASE 1.** Mrs. W. M. age 36 was admitted to the hospital April 14, 1911 complaining of pain in the abdomen radiating to the back.

Family history unimportant.

Personal history. The patient has had measles, mumps and whooping cough. She had typhoid fever ten years ago. She has suffered with stomach trouble for eight years manifested by vomiting and pain in the stomach radiating to the back. She had nine children the youngest being one month old.

**Present illness.** The patient gave birth to a child four weeks ago. Before the birth of the child she suffered from burning cramp-like pain in the stomach passing to the right shoulder and these pains have become worse and continued to the present time. They have required frequent hypodermics of morphia. Six days ago she vomited a large amount of bile stained material. At that time she was jaundiced. She had chills every night for a week after the birth of the child.

**Examination.** The patient is a thin woman and looks sick. The sclerotics are distinctly bile stained. The pulse is of fair quality, 90 to the minute. The temperature was 100 on admission. Leucocytes 9,000. Coagulation time four minutes. Urine analysis negative. The abdomen is flat and slightly asymmetrical there being a fullness in the right hypochondrium. On palpation there is considerable tenderness in the epigastrium and right hypochondrium. No mass can be felt in the epigastrium but in the right upper quadrant the edge of the liver can be felt 5 centimeters below the costal margin and beneath this a rounded body the size of a hen's egg which feels like a distended gall bladder. On inspiration it descends almost to the level of the umbilicus.

**Operation.** An incision was made through the upper portion of the right rectus muscle. The gall bladder was found to be considerably distended and numerous stones could be felt in it. The gall bladder was aspirated and a large amount of bile obtained which would seem to indicate an obstruction of the common duct rather than of the cystic duct. The gall bladder was then opened and numerous small faceted stones and one stone the size of a walnut removed. A careful examination of the common duct failed to reveal any stones. The pancreas was examined and the whole organ found to be greatly enlarged and fairly fixed in position. In places the limits of the gland were not well defined. In the transverse mesocolon near the pancreas there were several areas of fat necroses suggesting a subacute pancreatitis.

A large rubber tube was sutured in the gall bladder and the abdominal wound partly closed.

**Postoperative course.** The patient did fairly well for a few days after the operation then began to run a temperature and the pulse became more rapid. She died rather suddenly nine days after the operation.

**Autopsy.** About a liter of blood was found in the abdominal cavity. The mucous entry of the ascending colon was infiltrated with blood. The head of the pancreas was converted into a necrotic hæmorrhagic mass. Numerous fat necroses were found. The pancreatic ducts were patent but a firm calculus 5 millimeters in diameter was found in the ampulla of Vater.

**CASE 2.** Mrs. J. A. H. age 48 entered the hospital February 17, 1916 complaining of stomach trouble.

Family history unimportant.

**Personal history** The patient has never had typhoid fever. She had pneumonia 19 years ago has suffered with indigestion 15 years and has had four children with no complications during labor or puerperium.

**Present illness** About a year ago she had a severe attack of epigastric pain mainly upon the left side. The pain was intense and lasted about six hours. Since then she has had at irregular intervals similar attacks sometime with vomiting some times with diarrhea. There has been little if any temperature. Her pain has been in the left epigastrium some higher in the upper right abdomen than the epigastrium radiating to the back. She has never noticed blood in her stool. There has been no fever or other symptoms before or after the attacks.

**Physical examination** The patient is middle aged, well developed. There is no fever. The sclerotic are slightly yellow. The temperature is 101 pulse 90 of good quality. Leucocytes 15,000. Urinalysis negative. The abdomen is not distended. There is considerable tenderness in the gall bladder region and as far down as the appendix region. There is some tenderness in the epigastrium and to the left. No masses are felt. The liver and gall bladder are not felt. There is no dullness.

**Operation April 10, 1916** A high right incision was made. On opening the peritoneal cavity no free fluid noted. The gall bladder was found to be much thickened and to contain greenish fluid. Numerous small calculi were found in the lumen and in the neck. The pancreas was markedly thickened and firm throughout. No stones could be made out in the common duct. One large and several small mullerry tones were seen in the gall bladder and in the cystostomy duct. The pancreas was not incised.

This seems to be an example of an acute exacerbation of a chronic pancreatitis.

**Postoperative course** The patient had an uncomplicated recovery. The wound healed nicely. The general condition was good at the time of discharge four weeks after operation.

**Case 3** Mr. J. H. H. age 48 was admitted to the hospital April 8, 1916 complaining of pain in the stomach.

**Family history** unimportant.

**Personal history** The patient has been having attacks similar to the present one for the last five or six years coming on at intervals of several months and often lasting for several days but none has been so severe as this one. There is no history of previous jaundice, chills or fever. The bowels are

somewhat constipated and the stools of yellow color. There were no urinary disturbances. She is the mother of eight children.

**Present illness** About ten days before admission the patient was seized with severe cramp like pain in the epigastrium radiating to the back more to the left and also down into the lower abdomen. She suffered much pain and vomited almost continually for a number of days. The pain has been almost constantly present since the onset. The patient has been very tender in the upper abdomen.

**Examination** The patient is a rather stout woman. Her general condition seems fairly good. Her skin is slightly yellow and the sclerotic are definitely bile stained. Her temperature is 101 pulse 90 of good quality. Leucocytes 15,000. Urinalysis negative. The abdomen is not distended. There is considerable tenderness in the gall bladder region and as far down as the appendix region. There is some tenderness in the epigastrium and to the left. No masses are felt. The liver and gall bladder are not felt. There is no dullness.

**Operation April 10, 1916** A high right rectus incision was made. No free fluid was found in the peritoneal cavity. The omentum was found adherent to the gall bladder and showed numerous patches of fat necrosis. The gall bladder was moderately distended and contained one large stone without facets. There was considerable induration around the common duct but no stones could be felt in it. The pancreas was much thickened and indurated throughout its extent. A rubber tube was sutured into the gall bladder and iodiform gauze packed around the gall bladder and toward the foramen of Winslow.

**Postoperative course** The patient did fairly well for four or five days after operation. She then became more deeply jaundiced and began vomiting. The wound broke down throughout and became very sore and a thin brownish fluid vomiting became persistent. Then pulse became rapid and weak. The temperature which had been elevated since admission gradually rose and during the last days ran between 104 and 106. She died 16 days after the operation.

**Autopsy** A postmortem examination was made and revealed a subdiaphragmatic abscess containing fat necrosis in the great omentum mesentery and peritoneum. Fat about the liver and right kidney. The pancreas was adherent and as thickened with difficulty. Its head was entirely necrotic leaving nothing but a blackish debris. Its body and tail were intact but quite hard and showed nothing unusual on section. The pancreatic duct was necrotic and could not be found. No obstruction was found in the common duct.

# SURGERY OF SOFT PARTS, BONES, AND JOINTS, AT A FRONT HOSPITAL

BY MAJOR E H POOL M P C CAPTAIN B J LEE M R C AND  
LIEUTENANT P A DINEEN M R C  
With An E p d t ry F r

THE Ambulance 1 Ocean at La Panne Belgium under the management of Colonel Depage is one of the best known hospitals in Europe. From it have emanated many of the epoch making principles developed during the present war. But besides having been pioneers in many of these important advances the staff at La Panne is doing routine war surgery according to the most approved methods. It has been therefore a great privilege and of inestimable profit to us to pass more than two months doing active work in this institution.

Through the efforts of Major Lambert of the American Red Cross and the courtesy of Colonel Depage we were sent to La Panne as a team by General Bradley Surgeon in Chief of the American Expeditionary Forces. Our motive was to utilize the dull winter months in preparing ourselves as far as possible for the surgical work which we shall be called upon to do in the treatment of our men.

La Panne is a small summer resort on the coast of Flanders. East of Dunkerque and Calais and about six miles from Newport Bains which marks the Northern limit of the Western Front. It is composed of a former hotel with surrounding villas and a number of recently built wooden barracks. It can accommodate about 1000 patients. An auxiliary hospital is in course of construction at Vinckem about nine miles south of La Panne and about six miles west of Dixmude the center of the Belgian lines. The hospital at Vinckem consists of frame buildings of the barrack type. It is planned for 1400 beds and can be readily expanded to a larger capacity.

In order to make clear the position of La Panne from a military point of view we will outline the Belgian sanitary organization

1. A dressing station for each battalion with one medical officer and one student.

*Poste de secours divisionnaire* a variable distance from the front line to it patients are carried on stretchers. It is in charge of two medical officers. Few dressings are made the patients are transferred as soon as possible to motor ambulances.

3. *Front hospitals* of which there are three surgical namely La Panne Beveren and Hoogstaede. Medical cases go to Cabourg.

4. *Base hospitals* at Calais and Bourbourg (France).

Doctor Depage is in favor of modifying this system. He believes that there should be three lines from front to base each under the control of a front hospital. Thus cases from a front hospital would be sent to one or more specific base hospitals and the control and direction of cases would remain in the same hands throughout the treatment. Under the present system cases under treatment must be evacuated from the front hospitals such as La Panne during active bombardment or during busy periods when the hospital becomes full. Cases thus transferred are lost from a therapeutic and scientific point of view and the transfer is furthermore a disadvantage to the patient. In general however cases are treated from first to last at La Panne and it is primarily this fact which makes the service of such great value to the surgeon and the treatment so satisfactory to the patient.

At La Panne the wards are large barrack buildings of modern construction each accommodating from 100 to 122 patients. The surgical work is divided into five services.

Head spine neck and face Dr Jansen and staff

Thorax and abdomen Dr Debusieux and staff

Fractures Dr Vandevelde and staff  
Joints hands and feet Dr Deluz and staff

Soft parts Dr Limbrecht and staff

This subdivision of the work is admirable both for the patient and the surgeon

Accessory services are roentgenology neurology stomatology ophthalmology nose and throat and prostheses. A thoroughly equipped laboratory with efficient personnel of great value to the clinician moreover it has made possible much valuable scientific work.

The reception *prédiction* is an isolated barrack building into five pieces from the main surgical ward. It contains a reception ward of thirty beds a night operating room a roentgenological department and a barber shop. The latter facilitates the ear clipping and shaving of the entrants a proceeding which is of importance in eliminating lice.

A patient on admission is given a bed bath or in the case of ambulatory patients a tub bath. One fixed tub in the reception room suffices for this. The clothing which is removed after the patient is placed on the bed is put into a bag and sent at once to the disinfecting plant. We have seen no pediculosis among the ward patients and there is no indication that even the reception ward itself harbors lice.

The patient is given 1500 units of tetanus antitoxin his history is taken and chart begun. He is then examined by the Admitting Officer who is the roentgenologist. Most of the cases are taken at once to the X-ray department and from there to the appropriate ward. The system is simple expeditious and satisfactory. The roentgenologist is the director and is responsible for the co-operation of the assistants and the coordination of the work.

#### ROENTGENOLOGICAL DEPARTMENT

The roentgenological department is of necessity one of the most important features in such a hospital. Practically all cases must pass through it and the results of the early operations depend largely upon the thoroughness of the roentgenologists examination and the accuracy of his findings and report. The efficiency of such a depart-

ment depends largely upon the ability and trustworthiness of the man doing the work. At La Fenne a roentgenologist is always on duty.

A patient is taken to the X-ray room as soon as possible after admission before or after being put to bed according to the indications of the case. The routine method employed in a new case depends upon the site of injury. Thus in difficult cases such as shoulder hip gluteal region thigh thorax and abdomen the bathymetre of Dessanes is used. For the cranium plates are always made at once because it is often difficult to recognize small foreign bodies. For simple cases such as leg forearm and arm the Ledoux Lebard bonnet is employed the part is examined from different angles and the depth estimated. In most cases an effort is made to cause the foreign body to move during fluoroscopy. For this purpose pressure is made on the skin over the foreign body with the tip of a curved metal rod. Where the foreign body moves most freely it is probably closest to the skin.

In an incredibly short time Dr Peremans localizes all shrapnel. He marks on the skin the point under which each one lies making the mark as nearly as possible in the line of or in relation to the probable incision. This is usually quite accurately done because the roentgenologist in question has a good knowledge of war surgery and keeps in close touch with the surgical work of the institution. Such co-operation between the surgical and roentgenological departments is of great value but it necessitates the employment of a broadly trained medical man as roentgenologist. It appears imperative in a hospital doing a large amount of work.

On the history chart which has already been filled out I made a note somewhat as follows: right thigh ecchymosis 10x55 millimetres 65 millimetres in depth under the point marked on skin. Or in a case with fracture left leg fracture of both bones middle third much comminution.

Plate of fractured bones are always made as a rule at the time of the first examination. If the operator wishes further information Dr Peremans is always available and goes to the

operating room where his advice is often of much value. With experience the operator acquires the knack of finding foreign bodies quite readily when they have been localized as above indicated. One should remember however to mark with a scalpel the points indicated on the skin before painting with iodine. For localization in later cases especially in difficult regions such as thorax, brain or pelvis reliance is placed chiefly on the Hirtz compass. We saw astonishingly accurate localizations by this method. One of us removed an ectot about 1 centimeter in diameter from the psoas muscle within the pelvis through a trephine opening in the ileum. The foreign body had been localized exactly as to depth and closely as to direction by this method. We likewise saw a small ectot which lay at the base of the brain in the middle fossa removed through a trephine opening in the temporal region. In this case the central rod of the Hirtz compass was introduced to the depth and in the direction established before the operation, the legs of the compass being on the respective points previously marked on the skin. A powerful electromagnet was then placed in contact with the rod which was withdrawn. Attached to it was the foreign body.

For the late removal of foreign bodies from regions in which the field of dissection is not of necessity limited especially for very small foreign bodies the method of Ombredanne-Ledoux Lebard is often employed. For this purpose an operating room is attached to the X-ray Department. The room which can be darkened by shades is next to the night operating room from which supplies are furnished. The table is the Ledoux Lebard pattern with bulb beneath and protected on three sides by lead aprons.

Plates are always made in examinations subsequent to the initial fluoroscopic observation. In the case of fractures frequent observations are made.

A movable apparatus is available for use in the wards. For the localization of foreign bodies it is little used. Even bad cases are brought to the X-ray room because localization is much better done on a fixed table. For fractures however the movable apparatus

is imperative. Proper treatment in a large proportion of cases demands frequent X-ray examinations without disturbing the patient.

Records of plates for filing with histories are made on tracing paper. The bones are filled in with a soft carbon pencil and this is covered with varnish to prevent smearing.<sup>1</sup> Beautiful and quite accurate records are thus made.

The roentgenological department is managed by two doctors (Dr. Henrard and Dr. Peremans) assisted by two brancardiers who develop the plates. There is no clerk or stenographer.

An estimate of the work demanded may be had from the following figures:

650 consecutive cases 110 patients X-rayed with plates average 5 plates 350 fluoroscopic examinations

The apparatus is the Grand Contact Tourant de Gaiße 220 volts direct. Coolidge tubes are used exclusively. The Bilot table is used in the main room, the Ledoux Lebard table in the operating room.

We will summarize according to types of injuries the results of our observations of the practice at La Panne. As to the practical application elsewhere of the principles of treatment herein outlined it must be recognized that La Panne is unique in that it is a large permanent hospital near the lines in which treatment is begun soon after the receipt of injury and continued until the patient is cured. This is in marked contrast to the conditions which prevail elsewhere for instance in the United States Army where the wounded must be treated serially in different units. However most of the principles must be accepted as sound and should be adopted in so far as local conditions permit.

The subjects will be considered in the following order: treatment of wounds of the soft parts including bacteriological examination of wounds and primary and secondary suture (Pool); treatment of fractures (Pool); treatment of wounds of joints (Lee); treatment of wounds of hands and feet (Lee); Currel-Dineen treatment (Dineen); anesthesia (Dineen).



Since the object of this paper is to present accepted principles of routine surgery which are susceptible of practical application regional surgery is not considered. The thorax abdomen cranium spine vessels etc present problems which cannot be treated adequately in an article of this type.

#### WOUNDS OF THE SOFT PARTS (FOOT)

Wounds of the soft parts which are the most numerous may be taken as the basis or standard in the consideration of war surgery.

The aim in such wound is to render them surgically clean and to close them as soon as possible. The wound is rendered clean primarily by free excision of injured and contaminated tissues and the removal of foreign bodies.

The closure may be by (1) immediate or primary suture (2) delayed primary suture or (3) secondary suture.

The primary operation should be performed within the shortest possible time after the patient receives the wound. Let us visualize a tract or tract from the skin to the interior of the muscle of the calf containing a fragment of shell and pieces of clothing along its course and having for its walls lacerated muscle. We must recognize the existence of pathogenic organisms throughout this tract. One can readily imagine however that immediate wide excision of such a tract as a whole removing skin subcutaneous tissues upon ulcers and adjacent muscle together with shell fragment clothing and micro organisms contained within the tract will leave an aseptic wound provided of course the skin adjacent to the wound has been properly prepared and the operator has observed the same technique as in an ordinary clean operation. This in fact is the ideal aimed at practically it is doubtful if in any given case it is actually achieved. But however skeptical one may be as to the total eradication of organisms under the conditions which prevail in these wounds many of them after operation undergo repair as if aseptic and cultures and smears are often sterile.

The closure of the wound is made as soon as possible. If the excision is immediate and thorough primary suture is done. If the

operator is in doubt the wound is left open and sutured subsequently either after an interval of from one to six days (delayed primary suture) or after a longer interval roughly six to fourteen days (secondary suture). The determination as to the time usually depends upon bacteriological findings. Obviously the decision as to primary suture in a given case must be attended with much uncertainty a mistake may be costly to the patient. Therefore delayed primary suture is the safest and sanest procedure. But primary suture may be done safely in a large proportion of cases if good judgment is shown and the patient is carefully watched thereafter. However it is generally to be condemned when the exigencies of a service demand haste or when a case must be transferred a long distance or must pass into unknown hands soon after the operation. More over great caution must be shown in certain regions such as gluteal thigh and calf in which severe infection is prone to occur and to result disastrously.

For convenience of discussion wounds of the soft parts may be subdivided as follows.

I Wound by éclats or fragments of shells grenades or bombs (1) éclat retained (2) éclat not retained (chiefly *plaque en seton* — or through and through)

II Wounds by rifle or machine gun bullets (1) bullets retained (2) bullets not retained (*plaque en seton*) (3) without and (4) with considerable hemorrhage or laceration of muscle.

Some surgeons include shrapnel balls in the same category as rifle or machine gun bullets. This classification appears unwelcome on account of the lower velocity of the shrapnel ball and the fact that the German shrapnel balls are embedded in a pitchlike substance which can readily carry foreign material into the wound. Shrapnel balls therefore occupy a class between the éclat and the rifle bullet and when the surgeon is in doubt the wound should be treated as if made by an éclat. It is worth noting that shrapnel wounds are relatively infrequent in this sector.

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All of these wounds with the exception of those by rifle bullets in which the projectile is not retained in the tissues are treated in the same manner. We will outline this treatment.

#### *General consideration of operative technique*

One important feature which cannot be too strongly emphasized is that in the primary operation careful consideration should be given to the questions of ultimate closure of the wound and restoration of the function of the part. The treatment of wounds of the limbs will be described. These wounds are the most numerous and the most difficult to treat. The principles may be applied to wounds of other parts.

The skin incision should when possible be made parallel to the long axis of the limb because such a wound is far more amenable to suture than is a transverse wound. A transverse incision should be made in general only when the possibility of successful primary suture is practically assured. In the case of a deep transverse wound *en seton* it is better to make two longitudinal incisions and to do a funnel like excision inward from each rather than make a transverse incision with excision of considerable muscle tissue. In the former case primary or early secondary suture is usually readily done whereas in the latter primary suture is often impossible because of the difficulty of uniting the severed muscle and even when this is accomplished the sutures frequently tear out and allow retraction of the muscle with resulting dead space and breaking down of the wound. When the transverse wound has not been closed or has reopened secondary suture is longer delayed and is much more difficult. Moreover the functional result is less favorable on account of the transverse section of the muscle.

Next if two longitudinal incisions are made they should be placed as far as possible on different transverse planes. Naturally when the wounds of entrance or exit are on the same horizontal plane one has no choice the central or widest portions of the two wounds must be placed directly opposite one another. Such multiple wounds especially in the forearm are often difficult to close by secondary suture at a single operation. This

difficulty can be avoided to a large extent if the original operator has in mind in a broad sense the patient's interest and the ultimate outcome of the case. He should wisely plan his incisions should avoid undue sacrifice of skin and should record the amount of skin removed so that a later operator may properly estimate the potential elasticity of the skin.

The operation itself consists in the free excision of all tissues with which the foreign body has come in contact except vital structures the removal of which would interfere with the function of the part and cause permanent disability e.g. nerves large vessels and bones. *Free excision however does not mean ruthless blind butchery of the parts but rather careful intelligent dissection with liberal removal of such parts as should be removed and with equally scrupulous preservation of such parts as may be safely left.* The removal of tissue is begun by an incision of sufficient length there is no advantage in attempting the dissection through a short incision. The incision surrounds the skin wound at sufficient distance to remove all contused skin. (When there are two wounds one or two incisions may be employed as already described.) The subcutaneous tissues are removed as far as there is evidence of laceration or contamination. The opening in the aponeurosis is treated in the same manner as the skin. But the aponeurosis is of great value in secondary sutures of the lower extremity and shoulder and therefore should not be ruthlessly sacrificed. The muscle planes are now exposed and all traumatized muscle must be removed. This usually demands in early cases excision for about one centimeter on all sides of the tract. When the excision is complete all exposed muscle must look healthy and bleed and contract when cut otherwise its vitality has been diminished to such a degree as to favor gas gangrene.

Two details must be emphasized. First the tract should be kept in view and followed in the dissection from plane to plane. At times a grooved director may be introduced to facilitate this step. Second in cases where the tract is lost or for other reasons difficulty arises in locating the foreign body the Bergonie vibreur should be employed. This

failing tissues should not be blindly torn up but after free excision of tissues and a careful search for a reasonable time the operator should desist should leave the wound open and locate the body by other methods such as the Hirtz compass and remove it subsequently.

When the ulcer or tract is in proximity to a large vessel for instance the brachial vein the vessel should be inspected and if traumatized should usually be ligated and the contused portion excised otherwise secondary hemorrhage is likely to occur. But if the ligation would cause danger of gangrene it should not be done. Under such conditions primary suture should be made if possible and the case carefully watched. Care should be taken to avoid injury to nerves by careful dissection. Severed nerves should be united and if possible buried in muscle. The dissection should be made by planes muscles should be identified and dissected as much as possible in the direction of their fibers the situation of nerves and large vessels should always be borne in mind.

The consideration of nerves and vessels naturally brings up the question of surgical preparation and it cannot be too strongly emphasized that a thorough anatomical knowledge of the part is imperative. Every military surgeon should make a conscientious effort toward such preparation.

The postoperative treatment of the wound at Launne has been in general as follows:

1. Carrel tubes are introduced but no vaseline gauze is applied to the skin. Carrel Dakin solution is freely used. At the first dressing vaseline gauze is applied and the routine of the Carrel dressing is followed daily.

2. If hemorrhage is present or is likely to occur the wound is lightly packed with dry gauze or gauze soaked in hemostatic solution and the Carrel treatment is begun at the first dressing. Under the Carrel treatment the wounds usually remain free from purulent discharge and slough or if infected become clean quicker than by any other method which we have observed. There is one striking exception namely amputation stumps which often become covered with slough and are resistant to the Carrel treat-

ment. In these wounds many tubes are necessary and must cover the whole surface of the wound. But Vincent's powder applied generously to the dried stump for three days usually removes the slough.

Some operators do not use Carrel treatment at any time (Sinclair etc.) but prefer dry gauze. Others employ gauze soaked in flavine and other solutions. Bismuth preparations especially a combination of bismuth iodoform and paraffine known as b.i.p. is employed in many front hospitals. Bismuth poisoning is not unusual the good results attributed to the use of bismuth preparation may be explained in other ways.

Gas gangrene is a postoperative complication is not of frequent occurrence yet it occasionally develops. However it can usually be satisfactorily combated even after primary suture if it is recognized in its early stage as it should be. We saw a case of gas gangrene after delayed primary suture of a wound of the thigh which was sutured 4 hours after the initial operation of excision of tissues. High fever delirium and dyspnoea rapidly developed. Although severe bronchitis was definitely established Dr. Vandevelde suspected wound infection. Examination 4 hours after the operation revealed marked swelling and tympany on percussion over the anterior aspect of the thigh. The wound was opened the typical smell was at once noted considerable sanguinous fluid and gas were evacuated. Since the muscles appeared to be healthy they were not excised. Carrel treatment was instituted. Cultures and smears showed bacillus aerogenes capsulatus in small numbers. Immediate improvement resulted. In most cases however free excision of the devitalized muscles should be made as soon as the presence of gas gangrene is established.

Septicæmia is treated with much success by injections of peptone as suggested by Nolf of Liege. We saw two cases of staphylococcus and one of streptococcus septicæmia recover after this treatment. In each three blood cultures were positive. The streptococcus case was given 13 injections. The

routine procedure is to inject intravenously 10 cubic centimeters of 10 per cent commercial peptone every two days

Dissolve peptone in physiological salt solution distilled water or Ringer's solution in quantity to make 10 per cent solution. Sterilize 20 minutes or more at 120° C. It is allowed to stand 5 to 8 days then filtered or decanted into test tubes each containing 10 cubic centimeters. Test tubes are sterilized 10 minutes or more at 120° C. The solution must be clear. It remains good for 3 to 4 weeks if kept in an ice box.

*Wounds by rifle or machine gun bullets*  
Wounds *en seton* by rifle bullets projectile not retained are not as a rule operated upon. Infection usually does not result owing to the fact that the projectile rarely carries foreign material into the wound and more over penetrates with little laceration and traumatization of the tissues especially the muscles. However under certain conditions wounds *en seton* by rifle bullets must be treated in the same manner as those made by fragments of shell that is when the appearance and feel of the part suggests considerable hæmorrhage or destruction of muscle and when the wounds of entrance and exit are relatively large and lacerated rather than punctate. At close range a rifle ball exerts an explosive force or effect at long range it looses the end on spinning course and wabbles like a dying top and thus causes mutilation and laceration<sup>1</sup>

**Wounds of the face** Wounds of the face must be considered independently. However severe extensive and dirty the wound virulent pyogenic infection and gas gangrene are not prone to develop. This feature makes it possible by timely operative intervention to avoid in most cases the gruesome mutilation which in the early days of the war was

so often allowed to occur. The safe rule is to *repair the wounds of the face as soon as possible after the receipt of the injury without general excision of tissue.* The wound is cleaned thoroughly and only such tissue is removed as is definitely devitalized. Such wounds unite quite regularly. Secondary plastic operations are made to improve unsightly scars, reconstruct angle of the mouth, etc. The frequently associated fractures of the maxilla should be splinted by a surgeon dentist. The wire splint attached to the teeth as used by Dr. Rupprecht of La Poudre is relatively simple and comfortable; the results are good.

*Bacteriologic examination of wounds in dications for delayed primary suture* (a) After the primary operation of *debridement* and excision of tissues the wound is lightly packed with moist or dry gauze or the Carrel treatment is begun. Twelve to twenty four hours later the wound is dressed and a culture and a smear are made. A report based upon the smear alone or the smear and culture is returned as soon as possible. If no organisms are found suture is made. If anaerobic micro organisms or streptococci are present suture is not considered. A very few staphylococci do not contra indicate suture. We have seen the practical importance of this bacterial differentiation namely bad results from suture over streptococci and satisfactory results from suture over a few staphylococci.

b In some cases delayed primary suture is made after 18 to 48 hours without bacteriologic examination on clinical data alone that is the thoroughness of the original operation condition of patient and aspect of the wound. A culture and smear are made at the time of the suture. The subsequent treatment of the wound depends upon the clinical course and the bacteriologic findings.

*Indications for secondary suture* The routine generally observed is as follows. After 48 hours at the daily dressing a culture and a smear are made. These are examined in the laboratory. The first report therefore contains the approximate number of organisms per field and the varieties of organisms. Thereafter a smear is made every two days

Care must be taken not to touch the skin surface in making the smear since this vitiates the value of the report. From the smear a bacterial curve is plotted according to Carrel's plan. When the organism on two successive counts are as low as an average of one per two fields the wound is considered susceptible of secondary suture except when the wound has contained streptococci. In that case careful cultures are made from granulation tissue and the discharge from all parts of the wound.<sup>1</sup> Suture is not made if any streptococci are found. It has been observed that they are prone to lie dormant in small numbers but to flare up and to cause virulent infection after suture of the wound.

*Primary suture.* Primary suture or immediate suture of wounds with or without complicating fracture is now made in a large proportion of cases. There is a constant tendency to employ it on an increasingly large scale. The advantages are obvious; the disadvantage is first chiefly in the danger of closing within the wound noxious microorganisms especially bacillus welchii or other anaerobes and streptococci. The resulting gas gangrene or virulent pyogenic infection in a few cases will counterbalance many successful closures. The only means of rendering primary suture reasonably safe is by extremely operative care and thoroughness and judgment in the selection of cases for suture and finally scrupulous watchfulness for some hours and even days after the operation.

Under conditions such as a rush which demand haste in the primary operation or when the patient must be transferred a considerable delay is lost from control soon after the operation primary suture should not be made. We were told at a hospital that in one week four amputations had been made in cases of primary suture that had been done at hospitals near the front.

In all doubtful cases *delayed primary suture* should be elected. It is done in from one to three days and may be rendered safe by a bacterial check. The disadvantages

are the possibility of postoperative contamination of the open wound and the subjection of the patient to a second operation with the attendant discomfort danger of pneumonia etc. However these disadvantages do not equalize the risk incurred by primary suture in doubtful cases.

*Technique of primary suture* including delayed primary suture. Iodine preparation. The muscles and aponeurosis are approximated with interrupted catgut the skin and subcutaneous tissues with silkworm. It must be emphasized that in all primary and secondary sutures haemostasis should be as complete as possible and dead spaces should be avoided. After primary suture in muscular parts a pressure dressing should not be employed. A tight dressing may interfere with the circulation. A muscle with deficient blood supply is favorable for the development of gas gangrene.

*Technique of secondary suture.* The skin is cleaned with ether and painted with 3% per cent tincture of iodine. The incision surrounds the new epidermis along the wound edges a healthy normal skin edge must be present for a successful suture. The skin is freed in all directions as far as is necessary in order to approximate the edges with the minimum tension. Dense scar tissue or projections of granulation tissue are removed from the wound. The deep fascia is then approximated with interrupted catgut when possible. Usually this may be done in thigh and shoulder but rarely in the leg arm and forearm. The skin and subcutaneous tissues are closed with silkworm. Considerable tension may be allowed far more than we are in the habit of permitting in civil practice. If little skin was removed at the original operation the skin stretches in a short time tension is relieved and good union results. However in my observation the result of suture is directly proportionate to the degree of tension. If there is extreme tension infection may be expected. It is surprising however how well most of these wounds do even after some infection. I have seen no cases which required complete reopening of the wound exclusive of amputation stumps. Even in the worst cases the operation was of

advantage When two longitudinal wounds are on the same transverse plane in a limb with considerable loss of tissue in each one wound can usually be closed completely and the other closed in part A dry dressing is applied and the wounds are left for about eight days when the sutures are removed The un-closed portion then presents a flat clean granulating surface

The practice has been adopted at La Panne of giving tetanus antitoxin (1500 units) at all secondary operations which are made more than seven days after admission that is after the administration of the initial dose

### FRACURES (POOL)

Fractures may be subdivided for purposes of discussion into (1) compound fractures caused by projectiles (2) compound fractures caused by accidents and (3) simple fractures

*Compound fractures caused by projectiles*  
In all compound fractures caused by projectiles the wounds of the soft parts must be subjected to exactly the same primary treatment as wounds uncomplicated by fracture The bone complication simply accentuates the importance of expedition thoroughness and early closure The last is especially important here because it means the conversion of an open into a closed or simple fracture

The operative treatment of the fracture itself varies When the bone has been broken by direct impact of the projectile in other words if the trajet passes to the bone the fracture should be freely exposed very small fragments and displaced fragments which are detached from periosteum should be removed but the temptation to remove fragments freely should be resisted The bone is microscopically cleaned as well as possible without entering the medulla or removing periosteum As a matter of fact however little can be done in the direction of cleansing the bone and certainly nothing that is in any way comparable to the cleansing of soft parts by excision of tissues Free irrigation with saline solution is advantageous in order to remove minute foreign particles though some operators advise against irrigation

A bone which has been fractured by the shock of a projectile but presumably without

actual contact with the projectile is not in general unduly exposed in the dissection and does not demand any efforts at mechanical cleansing Here too fragments should be conserved as far as possible

In both of the above classes the subsequent treatment of the wound comes under the same general rules as apply to wounds of the soft parts alone primary delayed primary or secondary suture may be made and the Carrel Dakin solution may be employed as in wounds without fracture In the consideration of the closure of such wounds it must be recognized that the fracture in the event of infection exposes to the danger of osteomyelitis with the consequent increased danger to life limb and function The development of osteomyelitis particularly osteomyelitis of a serious grade is favored by a closed infected wound especially if the case is not carefully watched and the wound is not immediately reopened Therefore the advantage of delayed primary suture over immediate suture and the disadvantages of closure when the operation must be done hurriedly or the case must be transferred very soon into other hands are even more striking in the case of compound fractures than in wound of the soft parts without fracture Whether the wound is sutured or left open it is as a rule inadvisable to employ foreign materials such as wires or plates to hold the ends in position Foreign bodies favor the development of a severe grade of infection and osteomyelitis However I have seen them employed with satisfactory results in cases both of primary and secondary suture and have seen no untoward developments from their use Yet it must be emphasized that such cases have constituted a small minority and were carefully selected by experienced surgeons The most frequent employment of a foreign body has been an encircling wire to aid in reduction and immobilization when the wound is not sutured But in the presence of probable infection the ends of the fragments should not be fixed by the wire in such close apposition as to seal the medullary canal Wounds that are left open are treated in the same manner as those of the soft parts alone

In addition to the treatment of the wound in all of these cases provision must also be made for reduction and immobilization of the fracture. This is accomplished in numerous ways and frequently demands the exercise of considerable ingenuity.

*Apparatus for compound fractures* We will consider the treatment of fractures only at hospitals where the cases are retained for a considerable time. This review is based upon our experiences at La Panne and observation of the work of Sinclair Schlesinger and others at British Base Hospitals at Calais and Boulogne.

The diversity of opinion as to the merits of various splints and methods is astonishing but whatever method is employed careful observation and continuous care of the individual case is essential and without these no method will give uniformly satisfactory and trustworthy results. The long accepted rules of treatment must be followed namely reduction immobilization accessibility to the wound and comfort.

Perfect reduction should be aimed at and attained as soon as possible. For this the employment of a mobile X-ray apparatus is imperative and repeated observations should be made when necessary. In most cases traction must be used to secure reduction and prevent recurrence of the displacements. Sinclair even aims at producing an elongation of the fractured limb. He finds that proper traction will replace most of the displaced fragments. Further he believes that it will correct abnormal positions of nerves, veins and lymphatics and thus favor tissue repair.

The importance of immobilization cannot be too strongly emphasized. The fractured part should not be moved in such a way as to cause a change in position of the fragments. Therefore in general compound fractures will do better if dressed without change in the traction and immobilizing apparatus.

A detailed description of apparatus is unnecessary. An admirable practical summary is available in the *Manual of Splints and Apparatus for the Medical Department of the United States Army, 1917*. The application of the much used Balkan Blake method

of suspension and traction is accessible in *Le Presse Medical* November 19, 1917. Numerous other articles dealing exhaustively with apparatus for fractures have recently been published. We will therefore confine ourselves to a brief consideration of a limited number of splints and apparatus which may be employed for the treatment of compound fractures in base hospitals.

For fractures involving the *upper arm and shoulder* the straight metal rod support recommended by Sinclair offers advantages especially where traction cannot be applied to the arm for the employment of the Blake apparatus and where the situation of the wound precludes the use of a Thomas splint. The rod is supported by a rope from each end leading to an overhead pulley and weight. The limb in abducted position with elbow extended is suspended beneath the rod by flannel or canvas slings. Traction is exerted in the long axis of the limb by means of band glued to the forearm. From these a rope passes to the pulley and weight. This method gives traction in proper direction, fair immobilization, accessibility for dressings and relative comfort.

For *arm and forearm* the Blake suspension method in general best meets the indications.

For *wrist, hand and fingers* attention should be called to the Sinclair cock-up splint. It should be used more generally in late treatment or when the Carrel-Dakin solution is not employed also in certain simple fractures. It is an ingenious device with which almost anything can be done.

For the *upper third of the femur* which is one of the most difficult fractures to treat no thoroughly satisfactory method appears to have been devised. The net support and frame of Sinclair is favorable as to comfort, accessibility of wound and results but it requires much space, is rather expensive and troublesome in respect to nursing. Vandeveldt recommends and employs the long Thomas with modified Finochietto stirrup provided the ring of the splint does not interfere with the wound. In such an event the Thomas is omitted and the stirrup is used with or without suspension of the limb in such a splint as the Hodgen. The other limb is

abducted to the same degree and held in that position with traction by rope pulley and weight<sup>1</sup>

For the remainder of *femur and leg* traction by weight and pulley with overhead counter weight suspension is in general satisfactory. But for fractures of the femur the natural anterior curve of this bone should be studiously preserved as emphasized by Sinclair. *Lower third fractures* often demand traction applied through the condyles of the femur.

In *fractures of the leg* a useful modification may be employed which adds greatly to the comfort of the patient. A short Thomas splint is used reaching to the middle of the thigh where it is fixed by means of flannel bands attached to the skin by Sinclair's glue. The bands pass from below upward and are attached to the ring of the splint. This method was apparently first suggested by Laurie of the Third British Army.

We have modified the Thomas in such a way as to allow a cut out of the splint over a wound so as to provide accessibility in dressings. Moreover the splint is so planned as to have a support for the limb in transportation. This splint has been found useful in fractures of the leg. The same principle might also be of advantage for fractures of the femur. The Hennequin splint has likewise proved satisfactory and comfortable for fractures of the leg.

The Sinclair foot attachment to apply traction is admirable and is undoubtedly destined to replace to a large extent stirrups and bands attached to the leg.

*Compound fractures caused by accidents* These are operated upon as routine at La Panne and when it is possible the following procedure is followed. The edges of the wound are excised, contaminated or lacerated tissues are carefully excised, the fracture is exposed and as far as possible the fragments are reduced. Foreign bodies such as plates, screws and wires are not employed except in rare cases for the reason already given under

by Projectiles. The wound is closed by layers without drainage.

*Simple fractures* These are treated as in civil practice. For fractures of the humerus we have seen at La Panne Leclercq's apparatus used with much success. For the femur and leg Delbet's walking plaster (*appareil a marche*) is employed to a considerable extent with good results.

*Amputations* Amputations should not be done unless the part is positively beyond saving as a useful limb either as a result of the original wound or later infection. The guillotine amputation is often advantageous, cutting as low as possible on the limb. It is rapid and conservative. However skin flaps should be made where this is possible. The wound is treated with Carrel using many tubes which for convenience may be united together in a variety of ways before sterilization. One method is to fix a number of tubes about half an inch from one another by passing them through a series of holes in another tube. Another method is to sew the tubes to a large square of gauze. The tubes are so arranged that an area of the gauze exactly corresponding to the wound surface is thickly covered with the perforated portions of the tubes. If the wound presents considerable slough as is frequently the case Vincent's powder may be used to advantage. The wound and skin are cleaned as in the Carrel dressing, the wound surface is dried, the powder dusted on freely and a dry dressing applied. The case is followed bacteriologically just as wounds of soft parts and is sutured secondarily according to the same rules.

A convenient modification is to saw the bone somewhat distal to the section of the soft parts, its end is drilled and a copper wire passed through. The wire is left as a double strand about 8 inches long. It may be used conveniently to support the stump during dressings or while the patient is in bed. A rope from the wire leads to overhead pulleys and thence to a small bag which the patient can readily reach. The weight is so balanced as to support the stump. The patient may





given by Depage in *Bulletins et memoires de la Societe de Chirurgie de Paris* in December 1916

*Fourth period* July 1917 to the present  
Excision irrigation with saline and ether immediate complete joint suture immediate active mobilization This method was introduced by Willems some time before it was begun at La Panne by Dr Delrez where it has been continued by routine ever since Recent case reports by Willems may be found in the journal mentioned above for October 9 and November 13 1917

The treatment herein outlined is that followed at La Panne in the service under the control of Dr Delrez

The surgery of joints may conveniently be considered in the following classification

I Wounds by eclats or fragments of shells grenades or bombs (a) without injury of bone or with little injury of soft parts or bone (b) with much injury of soft parts or bone

II Wounds by rifle bullets (a) with little injury of soft parts or bone (b) with much injury of soft parts or bone

As indicated under the section on soft parts wounds by shrapnel balls occupy a position between wounds by eclats and those by rifle bullets

III Wounds by sharp instruments

IV Acute purulent arthritis

*Wounds by eclats or fragments of shells grenades or bombs* The treatment of wounds of the soft parts having been completely considered it is unnecessary to describe in detail the operative procedure for wounds of joints At the outset however certain important principles should be emphasized

First here if anywhere in the field of war surgery good surgical technique is absolutely essential

Second careful radioscopic and radiographic examination must always be made for the recognition of bone injury and foreign body localization may be of vital importance

Third during the operation every practical means of localization must be made use of in order that the position of the foreign body within or without the joint may be accurately established The retained body may then be

removed with the least possible injury to the joint

Fourth soft tissue dissection should here be carried out in the most painstaking manner in order that a joint not entered by the projectile may be spared an operative entry by the surgeon

Fifth the joint must not be opened without satisfactory demonstration of the wound of entry which may be exceedingly small and therefore difficult to find Under these circumstances if a foreign body is retained an incision is made over the foreign body itself whether it be within or without the joint To miss a small wound of entry is on the other hand just as serious a matter for acute joint infection may follow We have seen the development of a severe purulent arthritis of the knee result from such an error

Sixth complete excision of all soiled lacerated tissue and removal of all foreign bodies and materials is essential

Seventh irrigation of the joint with saline solution followed by flushing with ether is the usual procedure

Eighth *complete primary suture* of the joint is a vitally important principle in joint surgery

Ninth *early active joint movement* is of prime importance Moreover immediate movement is considered absolutely necessary if the surgeon believes that a considerable amount of blood has been retained within the joint in that event if the joint is immobilized it is believed that fibrin will soon deposit within the articulation and be followed by a benign arthritis This condition adds to the difficulty of restoring normal joint movement an opinion however which is based upon clinical experience only Upon the other hand immediate mobilization should be deferred for 5 or 6 days if there has been considerable loss of muscle tissue overlying an extensive body lesion A compressive dressing to obliterate dead space and a joint rest are here essentials

*In wounds without injury of bone or with little injury of soft parts or bone* the incision of approach to the joint must be determined by the situation of the skin wound of entrance and of exit or by the site of the foreign body itself There is therefore no rule for a

routine incision. For the knee however the lateral incisions are the more desirable made as nearly as possible in a vertical direction. The wound of entry into the joint and if one exists the wound of exit should be carefully excised and enlarged as much as is necessary. The superficial soft tissue wound and the opening into the joint must be sufficiently ample properly to expose the tract through the joint. An ecclat retained within the joint and all other foreign material must be removed as well as all soiled soft tissues. Loose or semi detached bone fragments should be excised and all soiled bony surface or articular cartilages rendered clean by the use of a curette, rongeur or gouge. Any subsequent procedure to reach and remove an ecclat retained without the joint is outlined under the section on soft parts. If the ecclat be small and embedded in the knee close to the attachment of the synovial membrane it is sometimes possible to remove the foreign body without entering the joint. This is accomplished by pushing back the synovial membrane until the ecclat is definitely extra articular. For certain cases a minute drain may be led down to the bone at the former site of the ecclat usually however this is omitted. Thorough irrigation of the joint with saline solution is then practised followed by flushing with ether. The surgeon should refrain from active rubbing or sponging of the synovial membrane as such a procedure is definitely traumatizing.

*Immediate complete closure of the joint* is then carried out. The synovial membrane is closed with an extra articular suture of fine catgut and the capsule with interrupted catgut stitches. The overlying muscles are approximated with catgut and the skin sutured with interrupted silkworm gut. If there has been considerable oozing a small drain of rubber tubing or rubber dam should be placed in the superficial soft tissues but never into the joint and removed within 12 to 4 hours. Closure without drainage is the absolute rule under every other circumstance for a drain increases the liability to infection.

*Active mobilization of the joint* is begun the following day and continued three or four

times daily and at least once during the night for the next few days. With lower extremity cases walking is begun if possible the day after operation and continued with increasing frequency day by day. Crutch support is allowed the first day then a cane is substituted and shortly this is also discarded. The upper extremity cases likewise be in early with light work about the ward with a brush broom or duster gradually increasing the joint movements. By the third or fourth postoperative day the active motions are made very frequently practically as often as the patient can be induced to do them. During the night the man is awakened two or three times and active movements insisted upon. Passive motion should never be used as traumatism may be done to the joint. The patient complains a good deal for the first two or three days of active movement but after that period he is reasonably comfortable.

*In case of much injury of soft parts or bone* the exposure may have to be a good deal more ample but the same general routine is followed. The operator must be parsimonious in his conservation of skin and soft parts as well as of capsule and synovial membrane for complete primary suture is the object sought. If the capsule is destroyed at its attachment to the upper end of the tibia or the lateral aspect of the condyle it is very difficult to make a satisfactory closure of the joint over this area. A defect anywhere in the joint capsule should be closed if possible by utilizing adjacent muscle or fascia. Even in the presence of considerable loss of bone if a fair articulating surface remains immediate suture is desirable. In dealing with the shoulder elbow and wrist the routine outlined for inconsiderable injuries is definitely indicated. With wound of the knee with extensive bony injury the period of rest and immobilization should be prolonged for several days and active movements should not be begun for a week or 10 days. The remaining management of the case should be definitely more conservative. In wounds of the ankle joint with much bony injury the procedure of choice is an astraglectomy with immediate suture wherever possible.

*Partial primary suture* should be attempted if complete closure of the joint soft parts and skin is impossible. An effort is made to close completely the synovial membrane and capsule and to approximate muscles and skin over the joint suture line. The angles of the wound are thus left more or less widely open and are packed loosely with dry sterile gauze and a gauze dressing applied. The following day the packing is removed and Vincent powder is shaken into the open wounds. Dry gauze is loosely placed in the wounds and a sterile dressing used. Such a dressing is renewed daily. Carrel Dakin solution with tube introduction is considered at La Panne less desirable in this situation than the wound treatment as described. It has seemed less effective than the powder in combating infection especially of the streptococcal variety. The postoperative course is necessarily tedious but the attempt at active motion and normal use of the joint is steadily persisted in. The ultimate outcome in joints partially closed may be one of the following:

1 Primary joint healing and a gradual closure of the wounds of the soft parts with or without a mobile joint. If no motion is preserved it is important that the ankylosed position should be the most useful one for the particular joint involved.

Primary joint healing and later a suture of the soft parts is accomplished. This however is seldom possible. The joint may be mobile or immobile.

3 Delayed primary suture of a joint is practically impossible to accomplish and secondary suture of a joint is exceedingly rare. At La Panne Dr Delrez has however twice successfully made a secondary joint closure in the past six months in both instances the joint involved being the knee. One of the cases was closed ten days after the primary operation the joint having remained practically clean throughout that period. The second case was closed after the development of a mild purulent arthritis which subsequently subsided.

4 *Resection*. This is indicated where the damage of soft parts or bone is so extensive that a reconstructed capsule or a satisfac-

torily functioning joint seems impossible. It may also be made use of where partial primary suture has failed to furnish a movable joint or has resulted in serious infection. Resection having been performed under the first conditions mentioned sufficient shortening of the limb may have been accomplished to permit the reconstruction of a complete new capsule and a closure of soft parts and skin. One case of elbow resection has been encountered in which it was impossible to make a complete skin closure at the time of resection but in which a secondary suture was successfully done several weeks later.

The management already outlined for joints is followed in the cases of resection but at least two weeks should elapse before the institution of active mobilization. Later some type of apparatus may be used to confine the joint movements within the normal range.

The operation is not infrequently carried out at La Panne for elbow cases whenever the injury to the articular surfaces is so complete that a reconstruction of the joint is impossible. With the knee however resection is very rarely done. The tendency seems more and more definite to resort to amputation than resection if complete or partial primary suture of the joint cannot be done. An earnest attempt is always made to accomplish at least a partial primary suture even at times in cases where many surgeons would decide for resection. Where partial primary suture cannot be accomplished resort is usually had to amputation.

5 *Amputation*. This is indicated when complete closure with an immediate resection is impossible or where functional disability or serious complicating infection exists. Moreover if either circulatory or nerve damage is irreparable or the injury to soft parts and bone very extensive amputation is done by disarticulating saving at the same time as much skin as possible for immediate or late closure of the stump. Loose sutures may be placed and dry gauze dressing applied. If part or all of the stump is uncovered Vincent powder with dry gauze is considered the best dressing. Later secondary suture may be made use of. In some instances an amputation above the joint must be performed be-

cause of soft tissue damage in and about the joint. This operation is often necessarily rapid for the patient's condition may be desperate.

**II Wounds by rifle bullets (a) with little injury of soft parts and bone.** With a through and through wound abstain from operative interference whether or not a fracture within the articulation complicates the joint wound. The bullet is not considered infectious and surgical intervention will add an element of possible infection and one more traumatizing factor. Thorough cleansing of the wounds and surrounding skin is carried out and sterile dressings applied. Active mobilization of the joint follows along lines already shown. Moreover, even in cases complicated by considerable fracture mobilization must not be postponed for serious loss of joint function may ensue. This practice is considered particularly important where the fracture lines are extensive within the joint.

If the bullet is retained within or impinges upon the joint it must be removed. The Hirtz compass being a satisfactory instrument of localization. The joint cavity is then washed out with saline and ether and immediate suture done. If the bullet is lodged in soft tissue in a reasonably accessible place it should be removed; if in bone it should always be removed as a rarifying osteitis frequently forms around it. A bullet may, however, remain impacted in bone for a few weeks without causing symptoms or disturbance.

**b With much loss of soft parts or bone.** In certain rare instances a bullet at very close range (frequently self-inflicted) or a spent bullet may cause marked laceration of soft parts or bone and sometimes both complicating a joint injury. Under these conditions the whole procedure is exactly the same as if the injury had been caused by an éclat. The bullet itself should be removed.

**III Wounds by sharp instruments.** Bayonet wounds or any other accidental incised wounds into the joint are very rare, only one having been encountered by Delrez in the past six months. An excision is done of soiled and injured tissue and the joint irrigated with saline followed by ether. Primary

closure is made without drainage and immediate active motion is used.

The best functional results seen by us have been cases with knee joint injury in which immediate suture gave primary union and active mobilization a splendid movable joint. The poorest results encountered have been those of the wrist and ankle. Dr Delrez has kindly furnished me his statistics during July 1917 in 67 cases of wound of the knee. The data follow:

- 4 cases with ut any lesion of bone complete recovery primary union and a good functional result in all cases
- 30 cases with a bony lesion in which primary suture was made. Complete recovery with satisfactory joint function in 21 patients. Four developed a purulent arthritis and resection was performed. Seven cases had excision of the patella done and 6 of these were included among the 2 satisfactory results. One of the examples of resected patella was included in the cases of purulent arthritis. There were 5 deaths in this group: the bony lesion on the cause being shock or some other complication.
- 13 cases with a bony lesion. The injury in each of these cases was so extensive that amputation was necessary.

It is important to add that in this particular series the injuries as a rule were of an extremely grave character resulting from the violent offensive upon that sector of the front.

Although the treatment outlined by Willems has yielded excellent results during a six months trial at La Panne the methods advocated and used by most surgeons suggest the possibility of a more conservative course being followed. Some points of especial interest wherein accepted surgical principles based upon experience may be at variance with the Willems treatment may briefly be considered.

All now generally agree that primary closure of joints is of vital importance but the principle of immediate active mobilization still has not received general acceptance. It is possible that the immediate active movement may interfere somewhat with wound healing and increase the liability to infection. A slightly longer period of postoperative rest for the joint may therefore be desirable. One case of shoulder joint injury from which



Fig 1 Modified Thomas split showing support for transportation and cut out for dressing with one bar of cut out removed for dressing and with both bars removed for dressing

an éclat was removed by one of us with primary suture and tube drainage of the soft parts for 16 hours but *with active movement deferred for 10 days* gave an excellent functional result. It seems possible therefore that the principle of reasonably early joint movement may prove the better one.

Resection of the knee is still done by many surgeons where partial primary suture is attempted by the new method. A movable closed knee joint wobbling to such a degree as to need a permanent apparatus to control a marked lateral mobility may very possibly be less desirable than a stiff resected joint.

General experience has been favorable to the use of Carrel solution in soft tissues. The use of dry gauze in open wounds of soft parts with partial primary suture of joints is not generally followed.

In cases of joint injury complicated by fracture the generally accepted practice is to immobilize the joint for a considerable period that the fractured bones may be maintained by proper alignment.

Nevertheless the results attained by Willems Delrez and others seem to justify their enthusiasm for primary joint suture followed by immediate active mobilization and to place the treatment on a fairly well established basis.

**IV Acute purulent arthritis** In the earlier days of the war the treatment of acute suppurative arthritis followed the lines laid down in civil surgery namely wide exposure of the joint frequent irrigation and absolute immobilization. Later Carrel Dakin was used in joints with the hope of rendering them sterile and amenable to secondary suture but save for a few instances the cases did badly and many ultimately came to resection or amputation. A little less than a year ago Willems inaugurated a new method of treatment for these patients. Later other surgeons also began to work according to methods out-

lined by Willems and in July 1917 Delrez began his work at La Panne. The principles of this treatment are briefly as follows:

1 The knee and elbow are usually opened laterally. Some cases however of knee joint infection where the opening has been made of necessity anteriorly and posteriorly have done equally well.

2 Use no drainage material as it will prevent drainage and carry infection into the joint.

3 Employ no irrigations into the joint. They may introduce infection.

4 Hot dressings are applied for the first 48 to 72 hours changed every two to three hours if very considerable joint swelling and local reaction follow the operation. This is a special feature of the joint treatment at La Panne.

5 Active movement of the joint from the very beginning should be carried out at frequent intervals during the day which practically means as often as every hour or two. The patient is awakened two or three times during the night and induced to practice active movement of the joint.

The essential element in this plan of treatment is the immediate and continued active mobilization. It is maintained that the joint will drain itself if active movements are faithfully persisted in. Even though the patient is quite ill with high temperature the routine of joint motion is conscientiously carried out. In the average case the patients are quite uncomfortable in the early weeks. The course may be long and tedious extending even over several months. The utmost patience therefore must be exercised by the surgeon in his management of the man and his lesion. Cessation of movement is usually followed by accumulation within the joint associated with increased pain and temperature reactions. No splint is used but support of the extremity may be furnished by a sling

or vertical traction attached to the Balkan frame. The results obtained at La Fanne seem to justify to a considerable degree this plan of treatment. The method is certainly very interesting but final judgment upon it must be reserved. It is possible that the pendulum may swing back a little toward the pre-war accepted practice of treating acute purulent arthritis. We are inclined to believe however that the method of active mobilization may offer more for the patient as to life and function than any yet devised.

In conclusion the writer desires earnestly to record his appreciation of the friendly advice helpful suggestions and kindly criticisms of Dr. Delrez.

#### SURGERY OF THE HAND (LEE)

Wounds of the hand are among the most frequent met with in the field of war surgery and therefore constitute an important surgical problem. Appropriate treatment applied early will yield excellent functional results in many cases. The watchwords are *conservation of tissue, primary suture and early active movement*. The simple injuries heal rapidly and allow a quick return to duty. Provision should be made therefore for proper treatment of this group close to the front. The more serious types of lesion however require a long period of convalescence and are frequently permanently disabling.

The local preparation for operation is accomplished with razor scrubbing brush soap and water under a general anesthetic which is always necessary for operation upon the hand. This cleaning up must be thoroughly done for the skin of the hand is always dirty. The nail should be cut short. Ether and tincture of iodine are freely used for the skin of the entire hand with a generous amount of the iodine under and about the nails.

Excision of tissues must always be made with a wound of the hand by shrapnel fragments of shell grenades and bomb and also by a rifle bullet at very close range. If this rule is not followed the course after non-intervention is usually unsatisfactory. The wound suppurates operation is necessary

and the course is often long drawn out. Operation is not done in the case of a through and through bullet wound. Removal of a retained foreign body is the rule save with a retained minute fragment which may cause no trouble.

The incision for the dorsum of the hand is made in a longitudinal direction for the palm generally longitudinal unless special indications require an incision parallel to the skin folds.

Conservation of skin muscles and tendon is important. The surgeon must constantly observe this precaution for wide removal may leave considerable dead space and thus interfere with healing and function. The barest edge of skin is sacrificed. A curette is always used in the depth of the wound to remove bits of foreign material and injured muscle. If a fracture is present the injured bone is curetted and loose fragment likewise removed. With wound on both palm and dorsum following excision of a seton injury a small piece of gauze drawn through the wound may aid in removing foreign materials. Injured muscle or bits of loose bone. Irrigation with saline further assists in floating out minute pieces of bone or other retained debris.

Immediate suture is done in the hand wherever possible. This may be made under conditions which would cause one to hesitate with wounds of other soft parts. If doubt exists as to the primary healing the wound should not be tightly closed and if it is thought wise a minute drain may be used for 1 to 4 hours. In other cases where complete primary suture is not accomplished delayed primary suture in 1 to 3 days frequently succeeds the surgeon being guided in its use by bacteriological wound examinations. The daily dressings before the delayed suture are usually made with dry gauze.

Early active movements of the hand and fingers are essential to a rapid recovery and a useful functional result and the patient is encouraged to persist in these movements. *Small dressings* of gauze held in position by adhesive facilitate these movements. One must constantly bear in mind that although the wounds of the hand may be small and

trivial all dressings must be done under the best type of surgical technique. A splint should be used if fracture without joint involvement exists. The treatment of the fracture following accepted lines of civil surgery. When fracture into a joint is present the surgeon must decide in each case as to the wisdom of early active motion or immobilization. The finger wounds follow the same principles as those laid down for the hand.

One special procedure advised and used at La Panne by Dr. Delrez is worthy of mention. With an injury of the thumb requiring amputation at the metacarpophalangeal joint and a coincident loss of the index and middle fingers including the second metacarpal bone, he believes that a more useful hand is obtained if the third metacarpal bone is also sacrificed. This gives a thumb stump with an intervening space between it and the fourth finger and provides a useful grip not possible when the third metacarpal bone is preserved.

#### SURGERY OF THE FOOT

The general principles established for the hand hold here also. Some essential points of difference exist, however, changing somewhat the details of treatment.

The incisions are in general made *longitudinally*, but they must be definitely more ample. The foot is thick and wide exposure is necessary to make a proper excision of injured soft tissues. If the through and through wounds are far forward it is usually better to prolong the incision through the web between the toes, thoroughly exposing the whole damaged area. A seton wound near either lateral border of the foot is best treated by a *transverse incision*. No important structures are thereby divided in injured soft parts are readily reached and subsequent closure is satisfactory.

The conservation of toes is less important than the saving of fingers and frequently a quicker and better functional result will be obtained if the toe is sacrificed.

*Primary suture* is the almost invariable rule to be followed.

In wounds complicated by fracture of the os calcis after the usual excision of soft

parts and removal of detached bone fragments, *primary suture* is generally attempted. The very serious foot lesions, however, must be left open with at most a partial suture done. Some of the cases require immediate amputation.

The need for early active movements is less urgent than with the hand, but the same desire for rapid restitution of joint function is present. A longer period of rest and immobilization is therefore generally allowed.

#### CARREL TREATMENT (DINEEN)

For routine ward dressings the doctor is assisted by one nonsterile nurse and one orderly. A dressing carriage contains all essentials. The doctor should scrub up with the same precision and care as for an aseptic surgical operation. He should put on a sterile gown and wear sterile gloves. It is impossible at a front hospital to follow the same elaborate system as to draping the wound, having numerous assistants, etc., as in a civil hospital or in a large institution far from the front.

We will presuppose that we have to deal with a wound of the limb which is surrounded by large pads as the outer and gauze as the inner dressing. The large pads completely encircle the part and are secured by safety pins.

A description of a typical dressing follows. The nurse has a long pair of sterile dressing forceps that are kept in a narrow necked bottle of 95 per cent alcohol, only the handle protruding. The soap water and the Carrel Dakin solution are kept in small sterile basins. A pair of sterile dressings forceps is passed handle foremost by the nurse. The nurse removes the safety pins from the outer pad. The surgeon turns back the pad allowing it to fall away from the wound. The nurse then passes a rubber sheet under the wounded part. All dressings not in direct contact with the wound are removed by the surgeon. A new pair of dressing forceps is then passed and the Carrel tubes and deep dressings are removed. The wound is carefully draped. Theoretically the draping should be done as for an operation, practically this is not possible for reasons of economy. Cultures



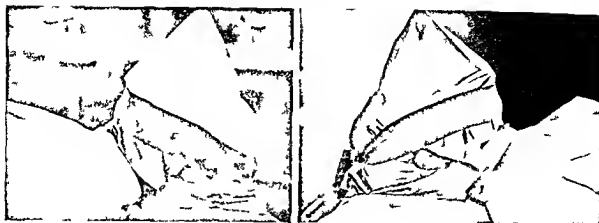


Fig. 1 (1 ft) Anesthesia mask "B M K" post. h. g. hole top of mask for admission of air

and smears are made before the vaseline gauze is removed. This avoids skin contamination. It is a mistake to make the smear or pipette the culture from the purulent looking Dakin solution in the bottom of the wound because very frequently the organisms contained therein are dead and of no use for media inoculation. It is better to remove this fluid with a tampon. Then a small tampon or pledget of cotton is gently but firmly rubbed across the wound smeared on a sterile dry slide which is flamed by the nurse. The nurse then passes by means of the long sterile forceps tampons soaked in soap solution being careful that the doctor's forceps do not touch hers and that the exchange is not made over sterile receptacles since drippings contaminated by his forceps would vitiate the technique. A receptacle is provided for the soiled dressings the exchange of wet articles should be made over a small basin.

First the skin is cleansed with soap warm water and brush if necessary. It is shaved every third or fourth day with a sterile razor from wound to periphery. The razor is returned to the nurse cleaned and placed in a tray of 95 per cent alcohol. The wound is then carefully cleaned and irrigated. For the irrigation there should be a tank of sterile water with a faucet outlet to which is attached a long piece of rubber tubing. The last foot or two of the tube lies in bichlorid of mercury solution. The end of the tube

is passed by the nurse with her sterile forceps. In one hand the surgeon holds the irrigation tip and irrigates the wound while in the other hand he holds a pair of dressing forceps and with a tampon removes shreds of fibrin gauze and other extraneous material. The irrigation finished the water is allowed to run out of the tube before it is returned to the bichloride solution. The nurse then passes sterile tampons with which the wound is sponged and the skin thoroughly dried. The skin is then sponged with ether. At this point the surgeon discards his forceps and receives one pair of dissecting forceps without teeth and a pair of dressing forceps. These instruments give the surgeon the best control. The vaseline gauze kept in a sterile tin box is passed piece by piece. The gauze is taken by both ends one inch from its border and drawn along the skin to the wound edge thus folding in the margin. Then the gauze is held fixed with the plain forceps and quickly smoothed out with the dressing forceps by one long sweeping stroke. The folding of the gauze prevents frayed edges and loose threads from coming in contact with the wound. Two details add considerably in applying gauze in inaccessible regions first to have the part dry and second to use only one layer of gauze which should be well saturated with vaseline. The nurse passes the Carrel tubes. It is absolutely necessary that every little cavity be sought out and tube inserted for every bacterial focus must be

reached. The distal ends of the tubes may be attached immediately to the Carrel bracket. The tubes should be so inserted that no holes are outside of the wound. Occasionally a sterile bandage is required to hold the tubes in place. Moist Carrel compresses are placed over the whole wound. A dry gauze dressing is applied over the whole area. The outer dressing pad is drawn tight and fixed by the nurse with safety pins after she has removed the rubber sheet.

Between cases the gloved hands are thoroughly washed in bichloride of mercury solution.

The vaseline gauze is prepared as follows:

Strips of gauze 8 by 3 inches are cut and arranged in layers five pieces deep. The first layer of five is covered with vaseline. Then five more pieces are placed on top and covered with vaseline and so on until the required amount is made. The gauze is placed in a tin box which has been smeared thickly with yellow vaseline on the inside. The cover is applied and a bandage tied around to keep the cover in place. The box is then placed in the autoclave 120 C for one half hour.

#### ANÆSTHESIA (DINEEN)

Anæsthesia plays an important part in the surgery of the war. Many fatalities can be attributed to it. A considerable number of patients are in shock, they have lost much blood, their nerve centers are in an unbalanced condition due to the life in the trenches and their general physical condition is often lowered by hardships, privations and restrictions. This is the type of patient which often comes to operation and a skillfully administered anæsthesia is strongly indicated. Each case must be carefully studied, observed and followed. Another point must be strongly emphasized. Many of these patients are admitted very shortly after meals and must be operated on immediately. If it can be established that the patient has taken food within one and a half to two hours before admission, the stomach, if possible, should be emptied before anæsthesia. The importance of this is shown by the fact that many of these patients vomit large quantities of



Fig. 3. Anæsthesia can be prolonged by the addition of ethyl chloride in the hole at top of mask.

food remnants during the anæsthesia, and the fact that aspiration pneumonia occurs in an appreciable number of cases. Dr. Sands has found in 57 consecutive autopsies 4 pulmonary infarcts, 17 bronchopneumonias, and among these 5 were aspiration pneumonias. Food particles were found in the lung on microscopic examination.

*General anæsthesia.* Ether is the safest and best available anæsthesia for routine use. It may be given either by the open drop method or by the closed method. For the latter the apparatus of Ombredanne is generally employed in Belgium and French hospitals. Chloroform is the choice of some surgeons, but it is dangerous. Gas and oxygen is not used to any extent. There can be little doubt, however, that this combination would be almost an ideal form of anæsthesia for many cases, as so large a proportion of these wounds are of the extremities and complete relaxation is not required.

War surgery necessitates the dressing of many painful wounds. A brief anæsthesia that affords the surgeon an opportunity to do his dressing thoroughly is a necessity. Savarand, a French Surgeon, has devised a method of securing anæsthesia that has proved very satisfactory, though it is not wholly devoid of danger. For its best results

very careful supervision is necessary. The mixture consists in general of 18 cubic centimeters of ether, 10 cubic centimeters of ethyl chloride and 2 cubic centimeters of chloroform.

According to the duration of the operation the mixture is proportionately increased or decreased. The apparatus for giving this anesthesia consists of a hood of some impermeable material as oil cloth, oil silk. The material used by Savariaud is *jacquonnette*. The hood measures 39 centimeters in length on each side and 29 centimeters wide and has a small opening on top. (See photograph.) Flannel, two pieces each 32 centimeters square. A rubber bandage (Esmarch bandage).

**Method of procedure.** Into a graduate 2 cubic centimeters of chloroform are accurately measured, then eighteen cubic centimeters of ether are added and finally 10 cubic centimeters of ethyl chloride. The receptacle must be covered tightly since the mixture, particularly the ethyl chloride, is very volatile. The fluids are added in the above order because the chloroform is the least volatile and the ethyl chloride the most. No time must be lost from start to finish or the force of the anesthesia is much diminished, thus seeming to emphasize the fact that the ethyl chloride is the most potent ingredient. The mixture prepared, one of the pieces of folded flannel is placed over the top of the graduate to prevent rapid evaporation. The anesthetist is now ready to give the anesthesia. One piece of flannel, not folded, is placed over the patient's face completely covering it. Then the mixture is poured over the other pieces of flannel which the anesthetist has been holding over the mouth of the graduate to prevent evaporation. This second piece of folded flannel is then placed over the nose and mouth and the hood quickly applied. The ears stick out through the two holes on the sides so that their color can be readily observed. The elastic band to secure the hood is then applied from chin to occiput. For this take the point of the chin and there apply the middle part of the bandage, run the band upward (keeping the band flat) just anterior to the ears and back to the

occipital protuberance before tying the bandage. A good purchase is thus secured and the mask will not slip off. Plenty of space must be left between the flannel and the hood for a rebreathing chamber.

By this method the operator can himself apply the anesthetic and then quickly return to the dressing or better a nurse administers the anesthesia and may then assist the surgeon. The patient is under the influence of the drug in from 30 to 60 seconds and remains under for a varying length of time from three to twenty minutes so that small operations can be easily performed. The anesthesia may be prolonged by the addition of ethyl chloride through the whole at the top of the mask (Fig. 3.) The average time for the painful part of the dressing is about three minutes and the mask is completely removed as soon as this is finished.

The anesthesia is convenient and satisfactory and under careful supervision fairly safe for routine dressings. But the anesthesia should be carefully watched throughout and the mask removed at the first signs of respiratory embarrassment which is usually the first indication of trouble. In the absence of other assistants the operator or the nurse assisting at the dressing can adequately follow the anesthesia.

**Local anesthesia.** Cocaine and its derivatives, particularly novocaine, are used considerably in plastic face surgery with good results. Extraction of foreign bodies from the brain, trephining and plastics may be done without much shock or discomfort to the patient. Ethyl chloride is very little used for local anesthesia.

**Transfusion.** So many of these patients are in shock and markedly exsanguinated that we are impressed with the frequent necessity for the use of transfusion as a life-saving measure. The type of procedure used will vary with the operator. The important practical point is to provide a constant supply of available donors and the group of each donor established. If one has the serum of groups II and III a patient's grouping is readily determined by a simple agglutination test. See accompanying chart for the inter-reaction of the various groups.

AGGLUTINATION CHART  
CELLS

Serum	I	II	III	IV	I per cent
I	o	o	o	o	8
II	+	o	+	o	40
III	+	+	o	o	10
IV	+	+	+	o	42

The wisest plan is to use only group 4 donors as this makes grouping of the recipient unnecessary. The cells of IV give no agglu-

tionation with any of the four sera while the serum of groups II and III protects its own cells against hemolysis by the IV serum.

In the operating room a small transfusion donor list is posted available immediately in an emergency.

The details of the method are given in an article by Major Lee, British Base Hospital No. 12 in the *British Medical Journal* November 24, 1917.

## THE TRANSPLANTATION OF BONE IN THE REPAIR OF CRANIAL DEFECTS

By CHARLES H. GILMOUR, M.B. (TOR.) M.R.C.S. (ENG.) TORONTO  
L. t. t. C. I. C. A. N. C. O. E. Chag. 15 g. ry. N. 6 Canad. (O. t.) M. t. ry. H. p. t. l. O. p. g. t. E. g. l. d.

LOSS of substance in a skull bone was so rare previous to this war that it was seen only occasionally where trephining had been performed for fracture of the skull or decompression for some intracranial lesion. During the past three and a half years the number of cases suffering from cranial defects has been rapidly increasing, probably resulting from the modern system of trench fighting. The injuries to the skull have, like wounds received in other parts of the body, been practically always infected, often being complicated by a foreign body lodging in the meninges or brain substance. This condition has necessitated free removal of bone either at the Casualty Clearing Station or base hospital according to the methods of Sargeant (1) or Cushing (2) and the patient arrives in England with a wound which is usually healed completely or may have a small discharging sinus.

This hospital receives cases directly from France and also transfers of Canadians from Imperial Hospitals. On January 1, 1918 the surgical service of this hospital had under treatment 1317 cases of which 1031 had been admitted in convoys from France, the remainder having been transferred from hospitals in England. From examination of the 1317 cases 28 were found to be suffering from cranial defects. Of the 28 cases 16 had been

admitted in convoys from France and 12 had been transferred from Imperial Hospitals in England. From these figures it will be seen that the average of cranial defects admitted to this hospital is over 2 per cent of the total surgical casualties.

This report is based upon 20 cases in which we performed a bone grafting operation for the repair of cranial defects. The practical use of bone graft has been a subject of much study to surgeons for more than a century. Professor Arthur Keith (3) has recently pointed out to us that John Hunter was one of the pioneers in bone grafting and fully realized its usefulness and value but failed to carry it to a successful issue on account of sepsis. In 1867 Ollier of Lyons published an important work in which he proved that transplanted compact bone could live with out its periosteum. Recently Major Hey Groves (4) has published a review of the work performed by Ollier, Barth, Axhausen and Maccewen during the past three decades and in the same article published the results of his own experiments with the grafting of bone in crabs. A careful analysis of their work shows that they all agree on several main points:

1. That compact bone can live and proliferate when transplanted.

2. That periosteum does not reproduce bone.

3 That the viability of the graft is increased if both *periosteum* and *endosteum* have been retained

In 1914 Gallic (5) of Toronto published a report of a series of interesting experiments. The conclusion he arrived at as a result of these experiments was that grafted bone dies but at the same time acts as a scaffold which becomes vascularized and which is invaded by osteogenetic cells from the host. From these invading cells new bone is produced. That grafted bone does not die as Gallic believed has been proved in a case reported by Sir Robert Jones (6) in which he had transplanted a long strip of tibia from the sound limb into the epiphyseal ends of a tibia whose shaft had been removed for osteomyelitis. The graft united to the host and grew rapidly according to Wolff's law and the case was discharged from the hospital. Six months from the time of the grafting operation the patient was knocked down by a bus and the grafted bone fractured in the center. The case was again under the care of Sir Robert Jones who had a series of roentgenograms taken during the recovery. These pictures show callus forming at the point of fracture and firm union resulted within the average time allowed for normal bone. Albee (7) has reported a large number of cases in which he has performed his sliding graft operation in simple fractures of the long bones. Roentgenograms taken later show firm union between the graft and the hosts. Sir William Macewen (8) reports a case in which he removed a large piece of a parietal bone when operating for the relief of cystic intracranial disease. The bone was preserved in warm saline solution for half an hour and then reimplanted. Five years later the patient died from a pulmonary condition and on reflecting the scalp it was found that firm osseous union had occurred between the reimplanted bone and the skull.

McWilliams (9) in his review concludes that the survival of a graft depends on the establishment of a sufficient blood supply and that blood supply is more quickly and efficiently established when both *periosteum* and *endosteum* are transplanted. Of the different theories advanced on the growth of bone it is

now generally conceded that the one taught by Sir William Macewen is the most conclusive. Macewen proved in his experiments that *periosteum* does not reproduce bone but merely acts as a limiting membrane and that new bone is formed by the proliferation of osteoblasts within the grafted bone itself and quite independent of the *periosteum*.

As a result of the conclusions of these investigators we believed that a very extensive field had opened where bone could be used in the repair of cranial defects. It will be seen by the statistics of this hospital alone that the number of cases in which there has been a loss of bone substance will average fairly high in the total casualties. It is realized that a cranial defect usually makes a man unfit for any active occupation and indeed judging from the marked degree of depression suffering and fear seen in many of these cases they will become wards of the State during their lifetime. Realizing this we have endeavored to develop a form of treatment which will help these men to become an economic part of the man power of the nation and not mere helpless dependents.

To ensure a successful result in our transplanting of bone we found there were several fundamental principles to be carried out in all cases.

- 1 No graft should be attempted until all discharge had ceased and the wound had been perfectly healed for three months. This time differs from the period we wait after the healing in long bones. In compound fractures of the long bones we insist that the wound must be healed for at least six months before operating. However we have found that operations on the skull can be performed after a waiting period of three months without fear of stirring up a latent infection. The great vascularity of the scalp is probably responsible for this difference.

- 2 Most careful aseptic technique both in preparation of patient and during operation.

- 3 The graft should be autogenous the crest and inner surface of the tibia being most suitable.

- 4 The *periosteum* of both the host and grafted bones should be retained as well as some of the *endosteum* in the graft.

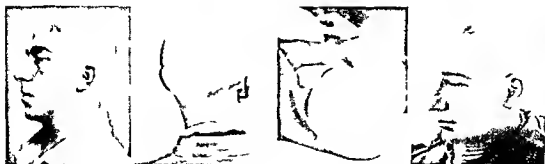


Fig. 1. Series of cases showing cranial defects

5 Close apposition and immobilization of graft into host

6 Small drainage tube in one corner of the wound for twenty four hours to allow drainage for the slight oozing which is impossible to control in the flap

In studying the case sheets of this series it is found that consciousness is lost at the time of injury in a large percentage of cases and is not regained for some hours at least and indeed often persists for several days. The notes on the field medical card accompanying the man although brief usually give most valuable and interesting data as it is from this we learn the extent of injury and the form and type of treatment carried out. When these cases are evacuated to England some weeks have elapsed and they are convalescent from their first operation.

On examination of the head a loss of bone substance is found usually showing a definite depression which markedly pulsates. The scar and area around the depression are sensitive and painful to touch. On interrogation the patient's cerebration is found to be slow and the memory poor. A constant symptom is an extreme degree of depression often associated with fear the fear being probably due to an apprehension of further injury to the pulsating cavity. He appears drowsy and lacks initiative. Severe headache is present in all cases. The headache is usually aggravated by movement. The headaches may be intermittent or of a continuous character but even in the intermittent type the man is never free from pain for more than a few hours. The constant headache is no doubt due to the dura mater which is almost entirely supplied by the fifth cranial nerve being firmly adherent to the old scar tissue and so under con-

stant irritation. Motor aphasia was present in three of the twenty cases and epileptiform seizures occurred in three cases. Vomiting may occur especially during exercise and after vomiting dizziness is marked. In all cases there were very definite and constant eye symptoms. In every case there was an abnormal contraction of the color fields some times being irregular and interlacing at other times being entirely absent resulting in a complete color blindness. Blurring of vision with a slight choked disc was common. Partial hemiplegia or monoplegia exaggerated reflexes areas of anesthesia and a marked abhorrence of noise have been found.

*Technique of operation.* Forty eight hours before operation the head is shaved great care being taken to avoid nicking the skin especially in the vicinity of the old scar. The head is well washed with green soap and water followed by ether and alcohol and a dry sterile dressing and cap applied. Twenty four hours preceding operation the head, face and ears are freely painted with tincture of iodine allowed to dry and a dry sterile dressing is again applied.

The anesthetic is of the greatest importance not only for the safety of the patient but also that it may be administered in such a way that the anesthetist will not obstruct the operator. In our first seven cases rectal anesthesia was used as follows. Two hours before operation the rectum was repeatedly washed until all fluid returned clear. One hour preceding  $\frac{1}{4}$  grain of morphine and  $\frac{1}{100}$  grain scopolamine was given hypodermically. To induce anesthesia four ounces of ether was well shaken with two ounces of olive oil and this was slowly introduced into the rectum at least ten minutes being taken



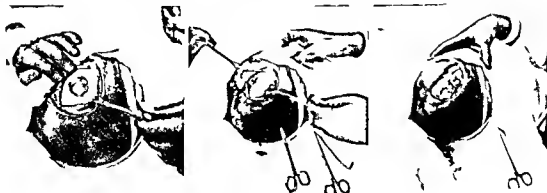
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F 3 C lpe m t ll O t t l l  
I 4 C Tl p t f t l I d

I 4 F 5  
h ld t m h l t t f m l a m t d  
j t l h m t t h t l b f d f m  
l b V l t l t b b l f t t b l

Surgical anesthesia was present in 30 to 40 minutes. While the anesthetic was produced was all that could be desired we decided after two unpleasant experiences resulting from shock occurring during the deep anesthesia that a form of anesthesia in which the patient could be permitted to come out quickly would be safer. Since then we have used an intra tracheal method which is most satisfactory in all respects.

To expose our cranial opening the horse shoe flap is used making the incision at least one and a half inches from the edge of the bony opening. In bringing down this flap one of the most important points in the whole operation occurs. The primary incision must be made only through the skin and subcutaneous layer and the flap thrown back

leaving the occipitofrontalis aponeurosis (galea aponeurotica) attached to the pericranium. This gives strength and an increase of blood supply to the pericranium which will form the covering and part of the blood supply to the graft. After reflecting the skin flap a longitudinal incision is made through the occipitofrontalis aponeurosis and pericranium over the skull opening extending to at least one and a half inches to either side of the opening. At the site of the old scar it will be found that the aponeurosis pericranium and dura mater are all matted together in a dense mass of cicatricial tissue. With care this scar tissue can be stripped from the dura mater providing that membrane has not been opened at the time of injury or first operation. The dura mater which



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I t b l h  
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B g f t m m b l d

I 6 F 5 C 6  
c m h b  
Oc p t f t l p  
d pen



Fig 9



Fig 10



Fig 11

Fig 9 Case 2 Showing loss of bone

Fig 10 Case 2 Showing pericranium reflected, outer table removed. Sutures threaded through inner table

Fig 11 Case 2 Removal of one piece graft from tibia

found firmly adherent to the edges of the opening in the bone is then freed and a periosteal elevator passed under the bony margin to see there are no adhesions here. If the dura mater has been opened at the time of injury or at the previous operation it will be found to be so densely involved in the scar as to make it impossible to separate without opening. If it is found necessary to open the dura mater it is done by making a crucial incision freeing the adhesions to the cortex and turning back the corners. This opening in the dura mater is closed by grafting a small piece of fascia lata with some fat adherent to its surface. The surface containing the fat is placed against the cortex and the fascia lata tracked to the dura mater at the corners by four fine catgut sutures.

The bed for the graft is now made by beveling off the outer table for a distance of half

an inch from the bony opening. To do this a Martel burr is attached to an Albee motor and the outer table is carefully removed leaving the cancellous and vascular diploe from which the skull receives its main blood supply to act as a fertile bed to receive the graft. Two or three holes are now drilled through the inner table with Albee's electric drill, a metal guard being placed between the inner table and dura mater to prevent injury to the brain. Twenty-day chromic catgut is threaded through these holes to be used in immobilizing the graft. The head is now covered with warm sterile towels and left while the graft from the tibia is removed.

To remove the tibial graft the bone is exposed for at least eight inches a flap being preferable. The inner surface of the tibia gives the best area. A graft the entire width of this surface an eighth of an inch in thick



Fig 12



Fig 13

Fig 14

Fig 12 Case 2 Immobilizing piece graft

Fig 13 Showing graft one and a half months after operation. Of the four holes drilled through the grafted pieces there have not only appeared

Fig 14 Showing graft one and a half months after operation. It shows definite callus around anterior and posterior ends of graft. Arrows indicate graft



ness and retaining it periotum is removed by using a saw the blade of which is narrow and can be turned to any angle.

On removal the graft is immediately transferred to its bed in the skull. The graft is never placed in saline or other media as any foreign substance tends to devitalize the graft. The periosteal surface of the graft is turned toward the dura mater only the area which will be on the diploë being bare of periosteum. The periosteum is turned toward the dura mater for three reasons.

1 To provide a smooth surface with which the dura mater may come in contact.

The periotum being a limiting membrane prevents any chance of infection growing from the under surface of the graft and eventually causing pressure.

3 The endosteal surface of the graft will be covered by pericranium.

When the graft has been carefully immobilized by tying the chromic catgut which has been threaded through hole drilled in the end of the bone the reflected pericranium and occipitofrontal aponeurosis is carefully sutured over the graft every endeavor being made to cover its entire surface. The scalp flap is now brought over and sutured with interrupted silk worm gut sutures a small drainage tube being left in one corner for twenty four hours. Plenty of dressings and a firm held bandage or cap which will give a fair amount of pressure over the operative area are applied.

Some doubt may be expressed as to the probability of these grafts living. MacCawen implanted nude bone shaving into muscle and peritoncum. In both cases they survived one graft actually increasing in size. It has previously been pointed out that the grafts in long bones live and as there is absolutely no difference between the osteoblasts of the skull and those of the long bones it follows that we have no reason to doubt that successful results should follow the skull operation. We have seen by monthly roentgenograms that the holes drilled to immobilize our graft gradually disappear proving that they were filled with granulation tissue which was invaded by lime salts ossification resulting. Five and a half months after the operation on

one case we explored and on cutting through the pericranium found it firmly adherent to the graft and on stripping it back the bare bone was seen to ooze freely. A small wedge shaped piece of the graft was removed and the laboratory reported that the specimen was living bone invaded by blood vessels.

The advantages of bone graft over metal and celluloid plates are:

1 The bone live and eventually becomes part of the skull.

It does not cause irritation or act as a foreign body.

3 An excellent effect is produced on the patient mentally.

Bone has the advantage over cartilage in that it retains its hardness and is as efficient a covering to the brain as the skull. Leticche and Folliard (10) have recently reported that examination under the microscope of cartilage implanted to close cranial opening in one case operated on 36 days and in the other one year previously the cartilage proper had been substituted by connective tissue. We found in two cases in which we used cartilage that after five months the graft softened and did not give the same amount of protection as did bone.

#### CONCLUSIONS

We would draw special attention to the following benefits from operative procedure:

1 Depression leave patient becomes optimistic and bright.

Headaches improved in all cases entirely absent in large percentage.

3 Memory improves dizziness disappears.

4 Eye sight improves the blurring of vision disappears and the color fields increase.

5 The man ceases to be a permanent ward of the state and becomes a useful citizen capable of carrying on any ordinary occupation.

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## PROBLEMS OF THE RECONSTRUCTION OF THE HAND

BY ARTHUR STEINDLER, M.D., F.A.C.S., IOWA CITY, IOWA

## MUSCLE MECHANICS AND MUSCLE MECHANICAL PROBLEMS

**R**ECONSTRUCTIVE surgery of the hand involves the following problems: (1) the work of the muscle and tendon reconstruction; (2) reconstruction of the peripheral nerves and re-establishment of the neuromuscular relations; (3) bone plasty, arthroplasty and autoplasty.

This paper deals with the first problem and its scope is to illustrate certain phases of muscle mechanics of the hand with proper application of the findings to clinical problems.

No matter how complicated and intricate the functions of the hand may become, they are subordinate to the most rigid mechanical and mathematical laws. The fundamentals of these laws are definitely known having been worked out thoroughly for muscle mechanics in general by the classical contributions of Pick (1), Weber (2), Strasser (3), Herz (4), Mueller (5), Rays (6), Frohse and Frankel (7), Virchow (8) and others.

The principal factors of muscle mechanics are the volume of the muscle, the tension, distance of contraction and the angle of application of force.

It would seem therefore that almost any musculomechanical condition could be worked out and calculated mathematically, but when in quest of such mathematical solution one is very soon aware of the fact that the problems become immensely complicated as soon as one departs from the most simple conditions.

Therefore, in introducing the fundamental mechanical values, the problems chosen had to be so simple as to be entirely hypothetical at least so far as conditions applying to the hand are concerned.

All other facts have been arrived at entirely by experimentation and carried out on anatomical specimens carefully prepared. This involves the great disadvantage that all readings of numerical values are subject to many sources of errors caused by the great differ-

ence between the anatomical specimens and the actual conditions in life. For this reason all figures given are only of relative value, that is, in relation of muscle to muscle in the same specimen, and they are to be taken as such in the accompanying charts. Where absolute figures are given they are taken from investigations of very careful observers such as Frohse and Frankel (7) and others.

Acknowledgment is due in this work to the very valuable co-operation of my assistant, Dr. E. L. Hobby, also to Dr. H. J. Prentiss, professor of anatomy, who most generously put at our disposal the ample material of the institute.

## JOINT MECHANICS

The carpal joints represent a central ginglymus which essentially carries flexion and extension movement. According to Virchow (8), the scaphoid moves in flexion and extension movements with the distal row of the carpal bones. The carpal joint of the radial side, formed by the scaphoid, trapezium and trapezoid, shows gliding motion in radial as well as ulnar abduction.

Since the scaphoid moves with the distal row in flexion and extension but with the proximal in abduction movement, the mechanical center of the hand for all motions must be located in the center of the os capitatum and here the center of the entire



Fig. 1 (at left) Case 1, M. W., 41 years, contracture.

Fig. 2 Case 1 after operation.



F 3 C 1 M C Sp 1 1 t  
l 4 C ft pe ti

F 4  
l 4 F d f l f p po f hyper t o  
(Spe m )

system must be placed. This is important if one endeavors to calculate the action of each muscle flexing and extending the hand upon the stabilization or mobilization of the wrist joint. It is clear that the sum total of work done by any muscle equal at any point the product of amount of contraction and the middle tension of the muscle (Strasser 3).

The action of any muscle upon the joint at any point must be divided in two functions namely that of stabilizing the joint and that of moving the joint bodies against each other. Geometrically these functions are represented by two components into which the sum total of the muscle action is resultant as divided (Chart I).

If  $m$  represents the resultant of force the component  $a$  rotating the joint and the component  $t$  stabilizing the joint will have the following value respectively in regard to  $m$ :

$$a = m \sin a$$

$$b = m \cos a$$

In other words since  $\sin a$  is greatest at 90 degrees and  $\cos a$  is greatest at 0 degrees the muscle is at its maximum stabilizing power when parallel to the long axis of the joint and its maximum rotating power when at right angles to its insertion.

Now in this investigation the author tries to show first of all that stabilization of the wrist in extension or slight hyperextension is of prime importance for all functions of the



F 5 (t ft) C se 3 I M Sp t c o t t  
F g 6 C e 3 ft p t



Fig 7 (at left) Case 4 V M Paralytic drop hand (contracted)

Fig 8 Case 4 after operation



Fig 9 (at left) Case 5 B C Flexionankylosis in the

Fig 10 Case 5 after operation

hand. If this is so anatomical conditions of the hand should be found to be in keeping with this principle that is we should expect the extensor muscles of the hand in such numbers as to insure stabilization of the hand in this position.

According to Frohse and Frankel (7) the numerical values of muscle weights for the hand are as follows:

- 1 Flexors of the wrist only
  - a Flexor carpi radialis weight 1,8 grams  
fiber length 3,8 cm
  - b Flexor carpi ulnaris weight 21,4 grams  
fiber length 4,8 cm
- 2 Extensors of the wrist
  - a Extensor carpi radialis longior weight 5,9 grams  
fiber length 7,6 cm
  - b Extensor carpi breviar weight 2,4 grams  
fiber length 5,6 cm
  - c Extensor carpi ulnaris weight 14,4 grams  
fiber length 5,3 cm

Also acting as extensors due to connection with second metacarpal are:

- a Extensor pollicis longus weight 13,5 grams  
fiber length 4,7 cm
- b Extensor indicis proprius weight 5,1 grams  
fiber length 5,1 cm

There is therefore in the first place numerical predominance of the extensors of the wrist over the flexors whereas on the other hand the flexors of the fingers greatly predominate over the extensors of the fingers.

What this predominance means in the given figures becomes clear when one considers the second fundamental principle of the

muscle action and that is the tension of the muscle.

The tension of the muscle is a direct function of muscle weight and fiber length

$$\text{Tension} = \frac{\text{weight}}{\text{length} \times \text{specific gravity} \times k}$$

$k$  being a constant equalling 10 kilograms for 1 square centimeter cross section area and specific gravity being so nearly 1 in living tissue as to be negligible.

Substituting in this formula the figures given for weight and length of each muscle would therefore result in the conclusion that in rough numbers the combined tension of the extensors of the wrist is to the combined tension of the flexors of the wrist as 14 to 7 or as 2 to 1. In other words the anatomy of the wrist is characterized by decided predominance of the extension power in the



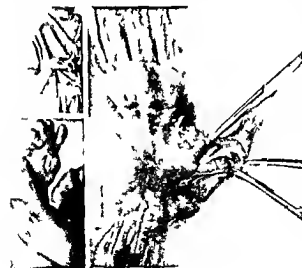
Fig 11 (at left) Case 6 F A Contractures of wrist and fingers

Fig 12 Case 6 after operation



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 l t 4 b l t l ft) C ft pe 1 N t  
 t f th ml  
 t 4 f l l 1 ml t f  
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writ The extension in the wrist as we shall see presently the one fundamental requisite which guarantees for the finger the optimum of flexion power in the meta



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 h d 6 (b l t l ft) C 8 fir p t n N t  
 opp 1 f th mb  
 F 6 T pl ly ppo ti f th mb obt d  
 by 1 pla 1 o h lf fl poll l (Spe  
 men)



I t t t ft) C o L D V l m n t a  
 t W t t t l t l p t l b  
 t e s C o L D ft l t f thumb Not  
 t t t f th ml

carphalangerl and the phalan eal joints or in other words the position which enable the fingers to display the highest amount of gripping power

This point has been made the object of experimental studie By observing the amount of contraction of the fingers both in extension and flexion of the wrist numerous reading have given me values which are represented in Charts 2 and 3 The e curves are called sine and cosine curves respectively

showing what each muscle will do in regard to stabilizing or moving the wrist joint according to the position of flexion or extension in which the wrist is placed But it is not only necessary to consider the mean tension of the muscle but also the fact that the muscle tension constantly decreases with increasing contraction In the so called middle position of the joint the muscle is in a state of tension midway between its maximum in full extension and its zero point in full contraction Only by considering this tension one can realize the necessity of hyperextension in the wrist for the display of flexion power in the fingers

Chart 4 shows the numerical value for contraction of the muscles both in flexion and extension of the wrist

As the wrist is placed in complete flexion

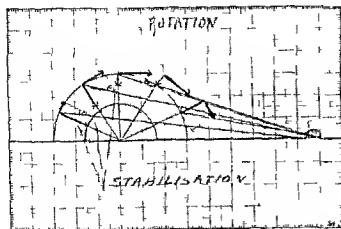


Chart 1 Shows rotation and stabilization components

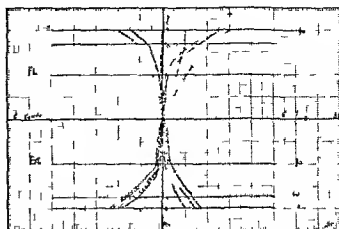


Chart 2 Sine curve of muscle action showing power of muscles of wrist maximum at 90 degrees

the amount of contractibility of the flexor muscles is already used up leaving only one half to one third of total contractibility of the muscles for the flexion of the fingers. The absolute amount of contraction of the finger flexors is not greatly different whether finger flexion is carried out in extension or in full flexion of the wrist but the fundamental difference is that as the wrist is placed in extension the following contraction of the finger flexors travels through the field of optimum tension of these flexors with the wrist flexed it travels through the field of minimum tension. In the first instance contraction takes place nearer the point of complete extension of the muscles in the second instance nearer the point of complete contraction of the muscles.

Chart 5 shows the diagram of this condition 3 and 4 being the tension field of flexion 3a and 4a the tension field in extension of the wrist. From this it will be seen that the absolute muscle power displayed by the finger flexors is many times greater in extension of the wrist than it is in flexion of the wrist. From this point of view all flexion contraction or deformity of the wrist have been dealt with no matter what the underlying conditions.

#### VOLKMANN'S CONTRACTURE

In cases of Volkmann's contracture the forced flexion of the wrist is evidently the starting point for all disturbances of the muscle equilibrium. The history of the

development of these contractures as taken in five cases previously reported (9) have brought out the following facts:

1 The flexion of the wrist is either the primary factor or else follows quickly flexion of the fingers.

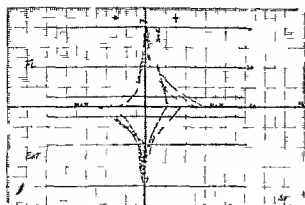
2 The extension in the metacarpophalangeal joints always follows never precedes the flexion of the wrist.

From the standpoint of muscle mechanics it is easy to understand why the hyperextension of the metacarpophalangeal joints is the later occurrence.

As the flexion of the wrist increases the reserve power of the flexors become less and less while that of the extensors constantly increases until there is a predominance of the extensors over the flexor muscles of the fingers.

With the wrist fixed in flexion the action of the extensors is directed toward hyperextension in the metacarpophalangeal joint. In this action the extensors are directly antagonistic to the interossei and especially the lumbricales. If these muscles are damaged as is the case in severe forms of Volkmann's contracture hyperextension will come about so much more rapidly.

In the treatment of this deformity therefore the release of the contraction of the wrist was considered to be of first importance and the treatment started accordingly. It was begun with the operative release of the contraction of the wrist by means of plastic lengthening of the flexor tendons. The after



Ch t t C Sh t b l h po f  
th m l f th h d t m m m t d k

treatment consisted in the application of a hyperextension splint and in daily massage and muscle training followed by systematic muscle education. Figures 1 and 2 show the result in one of the cases.

#### SPASTIC AND PARALYTIC WRIST DROP

Many students of this and kindred problems but by no means all of them have recognized the drop hand feature as the key note to the functional disability of the hand in cases of central as well as peripheral spastic or paralytic conditions. Consequently numerous operative methods were employed to produce hyperextension. The majority of orthopedists prefer tendon transplantation. Speed (10) Murphy (11) Axhausen (12) Gessner (13) Fischer (14) Spitz (15) some prefer arthrodesis (Goudier 16) and others arthrodesis combined with tendon transplantation (Lange 17) Cole (18) used the silk ligament method.

Many types of hyperextension splints have also been described to be used before or after operation (Grissette 19) Irlicher (20) Langemak (21) Tuffier (22).

In the case of wrist drop reported here an attempt has likewise been made to establish first of all the principle of hyperextension of the wrist. The transplantation of the flexors of the wrist directly upon the extensors of the fingers as practiced by some seems mechanically irrational. Unless the hand can be given the extension position first I cannot see how the extension movement of the fingers

even if such transplantation should prove successful would materially aid in bringing about the functional use of the hand. On the other hand extension or hyperextension of the wrist alone will materially improve the grip for the reason explained in the foregoing.

**CASE 1** L. M. age 11 admitted April 1, 1917. Spastic hemiplegia of the left side spastic equinus as corrected by tenotomy left hand in position of spastic flexion contraction.

This condition was treated by tenotomy and plastic lengthening of the flexor tendons. This corrected the flexion contraction so that the hand could be carried passively into hyperextension without resistance. A hyperextension splint was applied. Several months later permanent extension position of the hand was secured by the following procedure.

A dorsal incision was made over the radius and the extensor carpi radialis longior and brevior and extensor digitorum communis were carefully dissected. These tendons were pulled up and under strong tension and united to each other. The union between these tendons proximally from the septum dividing the two compartments of the annular ligament prevented a sliding forward of the tendons. This however was not sufficient to maintain the right in hyperextension and an arthrodesis of the wrist was therefore called for six weeks later. The hand is now held in hyperextension and does not drop. By a certain mechanism consisting in flexion and extension at the elbow the patient is able to contact and release the flexors of the fingers and in this way to pick up light objects from the floor (Figs 3, 4 and 4a).

**CASE 2** L. M. age 1 admitted July 12, 1917. Spastic drop hand from poliomyelitis.

Flexion contraction of the right wrist and hyperextension of the metacarpophalangeal joint as corrected by plastic lengthening of the flexor tendons of the hand. Following the operation the hand as placed in a hyperextension splint and exercises were instituted. Three months later the function of the hand was as follows.

Flexion could be carried out in the metacarpophalangeal joint and in the end phalange. The midphalangeal joint however remained fixed. This case is an example of the peculiar disturbance of the equilibrium brought about by the action of the interossei and the lumbricals. While working in the flexion of the metacarpophalangeal joints these muscles are entirely antagonistic to the superficial flexors of the finger in regard to the midphalangeal joint. Normally they take a check to the peripheral flexors so that the flexion of the midphalangeal joint by this latter muscle may be properly graduated. In this instance the flexor sublimis as considerably weakened and therefore could not displace any antagonists the lumbricals with the result that the hyperextension in the metacarpophalangeal joint was produced by the latter muscle.





after treatment however failed to accomplish anything in the way of releasing the extremely resistant hyperextension contraction.

For this reason the extensor communis and that of the fifth finger were lengthened operatively four months later by dorsal incision proximally to the annular ligament. This produced results in releasing the hyperextension by about 30 degrees for the fifth and second joints less for the fourth and none for the third but did not entirely correct the hyperextension.

A third operation was done four weeks after the second as follows: a curved incision was made over the dorsum of the hand making a flap with proximal base. The extensor tendons were found to be transformed in an irregular network of scar tissue having entirely lost the identity. After extensive incisions and resection of the scar tissue the hyperextension deformity could be completely overcome in all metacarpophalangeal joints except the third and flexion in this joint of about 30 degrees was obtained.

This enabled the patient to approach almost completely the fingers to the thumb after a period of two or three weeks. Under after treatment the use of the hand is constantly improving (Figs 11 and 12).

#### RECONSTRUCTION OF THE MOTION OF THE THUMB

The great importance of the thumb for the gripping motion of the hand has always been recognized and a great number of operative procedures are described with the object of either substituting the missing or mutilated thumb or to improve its function. In regard to the methods of substitution I shall merely mention the work of Nicoladoni (3), Schepelman (4), Kraft (25), Mayer (26), Horhammer (7), Hanley (28), Muriel (29) and others. The methods of autoplasmic substitution do not come within the scope of this paper. The cases reported concern methods of tendon transplantation and plastics only.

Biesalski and Mayer (30) in their splendid work on tendon transplantation describe one method which has been partially used in one of these cases.

**CASE 6** V. P. age 6 admitted July 17 1917. Polio encephalitis with hemiplegia of the right side. The spastic equinus condition of the right thumb was corrected by tenotomy. The condition of the hand is as follows: Flexion and extension can be carried out without great difficulty. Closing and opening of the fingers can also be accomplished although with a certain halt. But when closing the hand the thumb is always thrown under the fingers so that no grip is possible. This is due to the overpowering action of the flexors of the thumb. For

the relief of this disturbance of equilibrium between the flexors and extensors of the thumb an operation is made similar to the one described by Biesalski.

Incision is made on the dorsum of the hand over the metacarpal of the index finger and the tendon of the extensor indicis is dissected and split from the metacarpophalangeal junction upward. A second incision is made over the extensor pollicis longus. The severed half of the extensor indicis tendon is drawn through a tunnel and fastened to the tendon of the extensor pollicis so as to act as a check to the flexion of the thumb. The tendon sheaths are then closed and the wound sutured.

By this mechanism the thumb is given a springy resistance against flexion. After the operation the following condition was noted:

Whenever closing the fingers the wrist was placed in hyperextension for this purpose. Then the tendon common for the index finger and the thumb acted as follows:

It extended the index finger getting it out of the way of the thumb and then in closing the fingers together the thumb was checked just enough so that it would not be thrown underneath the fingers but would meet with the tip of the middle finger of the hand above which the index finger closes in at the same time. In this way the function of the hand was improved very considerably so that the patient was able to do handwork of different kinds (Figs 13, 14, 14a).

The following two cases represent instances in which opposition of the thumb was lacking due to peripheral lesions of the ulnar and median nerves. The last case was one of the cases of Volkmann's contracture.

**CASE 7** F. B. age admitted June 1 1917. Paralysis of the ulnar occurred 9 years previous following an accident to the elbow. Examination of the hand shows good action of the long flexors of the hand and wrist with the exception of the flexor carpi ulnaris. The thenar muscles are very atrophic especially the interossei and lumbricals which are paralyzed. The paralysis extends mainly into the sphere of the ulnar nerve but there is also some involvement of the short muscles of the thenar supplied by the median nerve. The thumb is held laterally to the side of the second metacarpal with hyperextension of the metacarpophalangeal joint. In all flexion movements of the fingers the thumb fails to participate on account of its entire lack of opposition. The condition remedied as follows:

Incision is made from the interphalangeal joint upward to the middle of the thenar directly over the long flexor of the thumb. This tendon is dissected out after its sheath is opened. The tendon is then split lengthwise and the radial half of it inserted periosteally to the radial side of the base of the proximal phalanx of the thumb. Closure of the tendon sheath and suturing of the wound.

By this procedure the long flexor of the thumb is

given a double insertion the normal one at the base of the end phalanx and a new one at the outer side of the base of the proximal phalanx. In this way not only flexion of the end phalanx is preserved but the thumb is also forced to swing over toward the palm of the hand in opposition to fingers.

One month after operation the function had improved very satisfactorily. The patient was subjected to persistent after treatment of massage and muscle education. She was very soon able actively to touch the thumb and the tips of all the fingers as shown in attached photographs (Figs 15, 16 and 16a).

CASE 8. L. D. age 9 admitted May 17, 1917. Volkmann's contracture following a fracture of the elbow three months previously.

This case has been described in the former series of Volkmann's contracture (9). It is mentioned here because of the fact that in this case also opposition of the thumb was entirely lacking as the muscles of the thenar and the interossei were paralyzed. After the contraction had been corrected by operation and after treatment the insufficiency of the thumb action was corrected by operation six months later.

The technique used was practically the same as for the operation used in Case 7.

The result of the operation was apparent as early as two weeks later when as the photographs show the thumb could be opposed to the fourth and fifth fingers (Figs 17 and 18).

In all cases mentioned the after treatment was directed first along the lines of massage and active and passive motion with the same principles and precautions as are used in tendon transplantation methods for the lower extremities. The patients are required to wear the splints day and night and they are only removed for and during the time of treatment. Following this mechanical treatment a great deal of stress is laid upon muscle education. This is carried out under the supervision of a trained teacher who is sufficiently instructed to understand the underlying pathological conditions. The children are made to use their hands according to the individual case with special consideration to those muscles which are in need of reeducation. Most of the patients start their work with clay molding in the most elementary form. They then proceed to the more complicated functions as reed work, raffia work, drawing, weaving, and so forth.

I have found that most of them make very creditable progress beyond the stage in which they are left at the conclusion of the medico-mechanical treatment. It is necessary to

carry out the work of muscle education entirely systematically and in such fashion that the individual requirements of the case is made the determining factor for all details of the work. Two points are essential:

1. Absolute individual instruction.
2. Constant medical supervision of the work of muscle reeducation.

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A NEW OPERATION FOR PROLAPSE OF THE UTERUS<sup>1</sup>

By CLIFFORD U COLLINS M.D. PEORIA ILLINOIS

THE operation that I present is designed for cases of complete prolapse where the uterine ligament have lost their elasticity as evidenced by the uterus remaining permanently outside of the body and not receding when the patient is lying down. Kocher's operation or Murphy's modification is usually done in this class of cases.

If there is a cystocele so pronounced that it is not reduced when the uterus and cervix are pushed back high up in the pelvis my operation had better be preceded by an anterior colporrhaphy that restores the anterior pelvic floor.

The patients who have the indication for this operation are usually patients well along in years who have had the accompanying derangement of bladder function for a long time. For these reasons they are handicapped patients and are not good surgical risks. They should be under observation for some time previous to the operation so they may be put in as good condition as possible. As the patient has not been able probably to completely empty the bladder for a long time there has necessarily been a back pressure on the kidneys. After the operation the patient will be able to drain the bladder at each urination and the back pressure will be sud-

denly relieved. In order to know how the patient's kidneys will stand the sudden relief of this back pressure it is wise to hold the uterus high up in the pelvis with a gauze tampon and to place a Pezzer catheter permanently in the bladder for some days preceding the operation. If the patient fails to stand well the continued drainage with relief of the back pressure the tampon and catheter can be removed and the patient kept under observation and treatment a while longer when the test can again be made. This test is similar to that suggested by Judd in cases of hypertrophy of the prostate gland. In failure to empty the bladder these prolapse cases are analogous to prostate gland cases.

Care should be taken that all preliminary details are completed before the anesthesia is begun so that there will be no delay during the operation which should be completed as rapidly as possible.

A transverse Pfannenstiel incision is made over the pelvis. After the transverse incision is made through the aponeurosis or anterior wall of the sheath of the recti muscles an other transverse incision is made about two and one half inches long paralleling the first incision and one fourth inch above it (Fig 1). The strip of aponeuro is thus formed has its

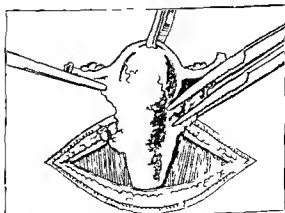
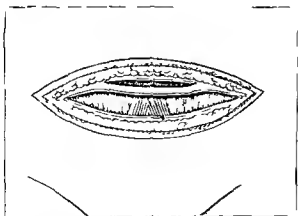


Fig 1. The Pfannenstiel incision made by the author.

Fig 2. The Pfannenstiel incision made by the author, showing the location of the uterus and ovaries.

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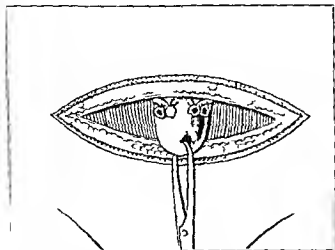


Fig 3 The cervix is held forward while the broad ligament stumps are sutured to its posterior surface and to each other

natural attachment at each end and is composed of tissue that does not stretch. The recti muscles are separated and the peritoneum incised longitudinally.

A supravaginal hysterectomy is done (Fig 2) removing a V shaped piece out of the cervix thus leaving an anterior and posterior flap on the cervix. The broad ligaments can usually be ligated *en masse* because these patients are generally elderly and there is more or less atrophy of the pelvic structures. While the two cervical flaps are held forward the stumps of the broad ligaments are sutured to the posterior surface of the cervix and to each other (Fig 3).

The cervical flaps are then held apart and the strip of aponeurosis is dropped in the

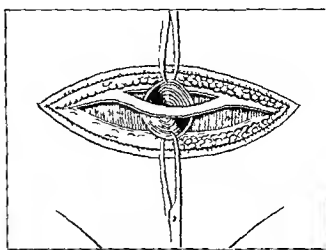


Fig 4 The cervical flaps are held apart and the strip of aponeurosis is laid in the trough thus formed

cervical trough thus formed (Fig 4). The flaps are then sutured together over the strip (Fig 5). The edges of the peritoneum and the recti muscles are sutured together around the cervix. The edges of the aponeurosis are sutured over the cervix leaving the strip dipping down into the cervix (Fig 6). With the suturing of the fatty layer and skin the operation is completed.

The cervix is thus held securely in the abdominal wall by a strip of aponeurosis that will not stretch and cannot come loose from its attachments because they are natural and have not been separated. The cervical tissue usually is hard and dense and when the two cervical flaps have united firmly over the strip it is not likely to give way.

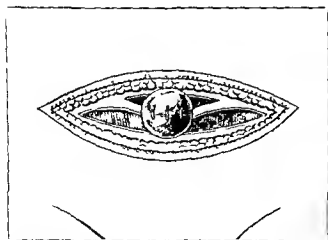


Fig 5 The cervical flaps are sutured together over the strip of aponeurosis

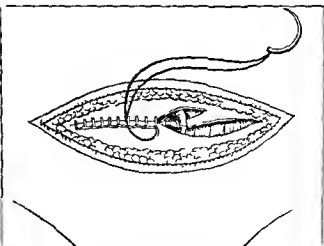


Fig 6 The edges of the aponeurosis are sutured over the cervical stump and the supporting strip

It seems to me that this operation is superior to Kocher's operation in that no comparatively large pieces of uterine tissue are left in the abdominal wall between the aponeurotic and muscular layers. The suspending power of Kocher's operation depends on the union of dissimilar structures — uterine tissue with muscle and aponeurosis while the strength of this operation depends on a normally attached strip of aponeurosis and

the union of similar dense structures (the anterior and posterior cervical flaps) over this strip.

In doing this operation I have found that the cervical canal is frequently a source of infection unless steps are taken to prevent it. I have tried tincture of iodine, carbolic acid followed by alcohol and the Percy cautery in the cervical canal and the carbolic acid and alcohol seems to give the best results.

## THE PRACTICAL VALUE OF ELECTRIC LIGHT IN THE TREATMENT OF INFECTIONS<sup>1</sup>

By A. J. OCHSNER, M.D., LL.D., F.A.C.S., CHICAGO

Read before the Chicago Surgical Society, May 1, 1908. (F. J. Ochsner, M.D., President.)

THE object of this paper is to direct the attention of surgeons to the great value of electric light rays especially because of their influence in controlling pain due to infection.

The rays of the sun have been used for many years and various special light rays have been employed to a great extent especially in sanitarium practice usually by enthusiasts in whose judgment neither the general practitioner nor the surgeon has had reason to place great confidence. As a result of this circumstance one has had the feeling that any apparent benefit probably came from the element of suggestion contained in the treatment. Most of the patients treated in these institutions are neurotics who require and demand some fad and whether the light is red or blue or ultraviolet the result is the same.

On the other hand the treatment of infections by means of heat is as old as medical history. There is a certain degree of heat connected with all light treatment consequently whatever benefit was not attributed to suggestion could easily be attributed to the heat accompanying the light.

It is a well known fact that there is a marked physical difference in the wave lengths of different light rays and a difference in the length of waves caused by the heat obtained

from heated objects and those obtained from light and there is a corresponding difference in the depth to which these rays penetrate.

One could write a book on the differences existing between these rays and build up fine theories upon the effects of these differences but my object is to set forth clinical observations and to leave the physics of the subject to others.

Four years ago when I suffered from a violent infection of my elbow it became necessary to expose the ulnar nerve when the abscess was laid open. This gave rise to intense neuralgic pains which continued for many days without cessation notwithstanding the use of wet and dry heat.

At the suggestion of Dr. Saurenhaus I applied an electric light apparatus similar to the one shown in the accompanying figure. Within an hour the pain disappeared not to return.

My natural skepticism regarding the effect of therapeutic measures led me to think this might be due to coincidence and that possibly the pain might have subsided at this time had we not employed the electric light.

During the past four years however I have had an opportunity to test this method at the Augustana Hospital in 78 similar cases of infection of the extremities and invariably the pain has disappeared promptly. Sixty one

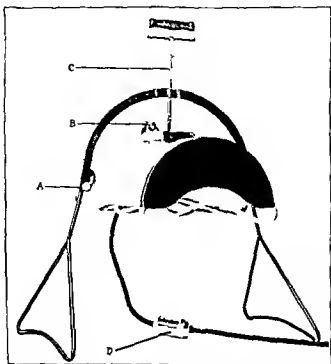


Fig. 1. Adjustable electric therapeutic light. A Lock on folding stand B adjustable reflector C rod for elevating and lowering reflector D button for regulating number of lights used

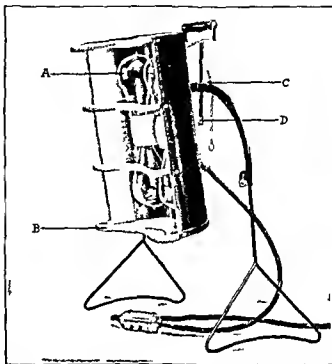


Fig. 2. Reflector adjusted for treatment of side of patient

of these cases were infections of the upper extremity and 17 of the foot

In order to illustrate the type of cases in which the use of electric light is especially valuable I will quote the history of an illustrative case now under my care at the Augustana Hospital

Mrs L. P. age 64 Case No 53451 admitted February, 1918 Family and past history unimportant

**Present complaint** Eight weeks ago the patient's little finger became infected. It grew red and became swollen the swelling involving the entire hand and forearm. The third finger was markedly involved. During the past seven weeks the little finger the third finger the palmar and dorsal surfaces of the hand were lanced seven times four times producing pus and three times serum. There has been much pain in hand and arm during the entire time. Some light soreness was noticed on third day of infection in the axilla. The treatment has consisted in free incision of areas suspected of containing pus and thorough drainage by means of iodoform wicks and the application of large moist boric acid dressings.

Immediately after admission the patient was placed in bed a large moist dressing was applied and covered with rubber cloth the forearm and hand were placed on a splint and the electric light was applied. A small amount of fresh hot boric acid

solution was poured into the dressing every three hours sufficient to keep it wet. The electric light was kept in action night and day. The dressings were changed every forty eight hours.

Within an hour after the application of the electric light this patient was free from pain and she has remained free. Within twenty four hours after beginning this treatment the facial expression of the patient has changed from that of a discouraged severely ill person subjected to extreme suffering to one free from pain contented and hopeful. The wounds improved rapidly. Within the first week the sloughing tendons could be removed without pain.

In the meantime we continued the use of large moist dressings covered with rubber cloth adding a small amount of the fluid every three hours to keep the dressings moist. The hand and forearm were immobilized by means of a splint placed underneath the forearm and hand and the hand was carefully supported during the change of dressings. All unnecessary pressure and manipulations were avoided. The gauze drains which were present when she entered the hospital were removed at the second dressing and no new drains were inserted. The bone of the second phalanx of the third finger was removed at the second dressing as it was perfectly loose in its place.

Our experience has been practically the same in all of our cases of this class and neither we nor our patients would be willing to go on without the use of light in the cases.

It seems to me that this operation is superior to Kocher's operation in that no comparatively large pieces of uterine tissue are left in the abdominal wall between the aponeurotic and muscular layers. The suspending power of Kocher's operation depends on the union of dissimilar structures — uterine tissue with muscle and aponeurosis while the strength of this operation depends on a normally attached strip of aponeurosis and

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5 Ch. A. H. p. al. d. S. M. r. v. N. h. l. p. t. P. f. s. o. f. S. g. r. y. U. r. s. y. J. H. C. H. g. M. d. u.

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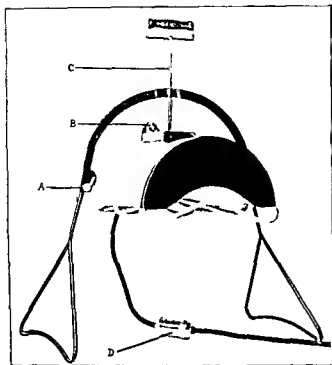


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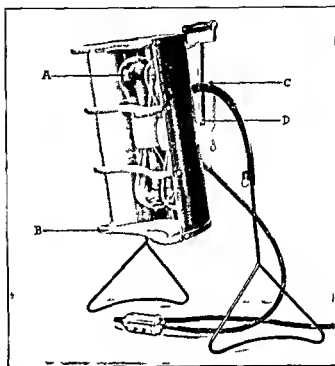


Fig Reflector adjusted for treatment of side of patient

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Mrs L P age 64 Case No 53431 admitted February 7 1918 Family and past history unimportant

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Our experience has been practically the same in all of our cases of this class and neither we nor our patients would be willing to get on without the use of light in these cases.



We have had equally satisfactory result in the use of the electric light in treating peritonitis following abdominal sections for the relief of suppurating conditions such as appendiceal abscesses perforated gall bladder etc. also in tuberculous and gonorrheal joint infection in carbuncles and furuncles.

In case of X-ray burns the light treatment causes a rapid improvement of the condition and one of my assistants who had an opportunity of treating many patients suffering from frozen extremities assured me that his results were much better with electric light than with any other form of treatment. George W. Crile reported that in many French hospitals infected wounds are exposed to the continuous rays of ordinary electric light bulb. He was impressed with

the fact that there was a marked decrease in pain and that wound healing progressed very satisfactorily under this form of treatment.

I would strongly urge all of my colleagues to give this treatment a careful trial and I am confident that all will adopt it. I believe that the general introduction of this form of treatment of septic wounds especially of extremities in army hospitals would result in great reduction of suffering as well as a rapid improvement in the condition of the wound.

The apparatus which we have found most useful consists of a simple reflector underneath which one or two ordinary electric light bulbs are suspended. The amount of heat can be varied by changing the bulbs to increase or decrease their candle power.

# DEPARTMENT OF TECHNIQUE

## BONE-GRAFT AND ARTHRODESIS IN RECONSTRUCTION SURGERY<sup>1</sup>

By F. G. DUBOST, M.D., F.A.C.S., SELMA, ALABAMA

THE war has given an impetus to reconstruction surgery. It has been suggested by the Army Medical Department that civil surgeons begin to round up the crippled and deformed in and among their clientele and to advise that such surgery be done on them as will tend to place them in a functionally more useful condition.

This is a preparedness propaganda conserving the resources of the state in increasing the efficiency of every deformed individual and fitting the surgeon to meet a probable demand for restoration to function of those maimed in the fight for universal freedom. No greater source of enthusiasm than one's patriotic desire to do his part is needed to meet this demand among those of us whom circumstance has kept at home and it is hoped it will perfect our skill and technique that we will not fail.

Orthopedic surgery affords a fertile field for useful work. This branch has not been attractive to the majority of surgeons for reasons which arise from two different points of view held by patient and surgeon: the former expects an absolute anatomical functional and cosmetic restoration with an immediate return to normal appearance and usefulness; the latter hopes primarily to re-establish functional usefulness and along with it such anatomic and cosmetic results as are compatible with the maximum degree of serviceability and is satisfied with ultimate and partial restitution. The result is a distressed though benefited patient and a doctor chagrined with disappointment. The psychology of enthusiastic endeavor depends on more than the factor of self-satisfaction; the pleased patient is no small incentive in this matter. It is an essential safeguard that a none too optimistic outcome is pictured to

the patient better obtain benefiting results beyond the promise than to fall below an assured expectation.

There is a tediousness or time-taking element in reconstruction surgery greater than in ordinary operations particularly in the contrast noticeable when compared with abdominal surgery especially that done for acute conditions both in operation and subsequent course of after treatment. There is a pain habit existing as truly as the status epilepticus and painful distortions endured over many years require a long interval of time after operative relief before the pain impulse is obliterated which is as discouraging to the patient as it is irritating to the surgeon.

It is not my purpose to demonstrate any new technique but to emphasize some of the fundamental factors making for success with reference to apparatus and appliances as well as certain precautions apparently or evidently essential before during and after operating and to make a plea for early operation in destructive joint disease in metastatic osteoarthritides doing radical arthrodesis before extensive destruction of joint structures or bony framework has occurred. In the light of more extended experience it may be predicted that delay in operating on infected joints of certain selected types may soon become as reprehensible as that of delay in operating for osteomyelitis.

Preliminary preparation of the patient in building up resistance with vaccines protecting with sera elimination of intestinal toxins alkalinizing the system loading it with carbohydrates in the form of glucose and filling the tissues with fluids before and in prolonged operations by hypodermoclysis during the operation are all well understood in fact commonplace yet need constant em-

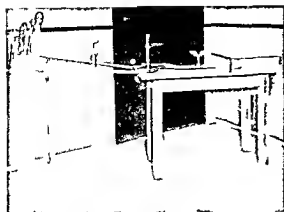


Fig. 1. Orthopedic table modified.

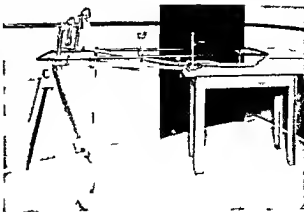


Fig. 2. Orthopedic table modified.

physi not only because they are element of success in the desperate case but they also add a world of cooperative comfort in every case when judiciously employed.

The equipment essential for the best results in arthrodesis and bonegraft surgery unless the surgeon has a mechanical turn or talent must be extensive and well equipped. I will demonstrate by model and photographs a practical working but in equipment which is both inexpensive and efficient. The table here shown when to it is added the portable attachment will at a small cost do all that the more elaborate and expensive table will do. This modified Bradford frame is really a product of the University of Pennsylvania Hospital implanted. The frame

can be made in any plumbing shop. It has the splendid advantage of permitting the patient to be moved in bed for bathing and for defecation without pain or disturbing in any way traction extension or position of the parts and of retaining the parts in exact apposition during any desired changing of patient who can be moved out on to a porch or into a sun parlor with ease as the frame and patient are all one piece. Among other advantages the frame and canva can be placed over either the orthopedic or operating table and the adjustments made during or on completion of the operation fixed and retained before the patient is moved. In some instances this is an important factor particularly in arthrodesis and in certain fracture with insecure fixation by bonegraft.

A simple extension apparatus is made by inserting a high pulley into a pine board for extension the board is placed at the foot of the bed and secured by cord. For an overhead trolley a long piece of timber two by two with screw pulleys at interval is supported over the bed on four pieces two at foot and two at head of bed. Various wire angle iron tubular frames or splints can be made at any blacksmith shop to suit the case in hand. The excellent tailor made splints and are vastly superior to the stock pieces advertised or sold by instrument house particularly is this true of the Thomas and other wire splints in general war use. Add to this plaster of Paris bandages with a few strap and buckles and a definite knowledge

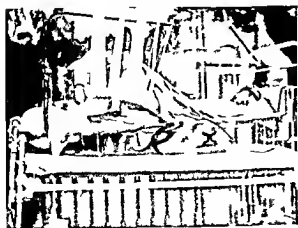


Fig. 3. Orthopedic table modified.



Fig 4

Fig 5

Fig 6

Fig 4 Case 1 Osteoarthritis Complete destruction of the head and neck of the femur Displacement of the upper end of the femur Osteomyelitis of the upper third of the shaft

Fig 5 Case 1 after operation

Fig 6 Case 1 Photograph of hip after reconstruction

of what one wishes to accomplish and the armamentarium for a working basis is complete

Technically the joint bone and tendon operations are not more difficult but the successful outcome is more largely dependent on absolute asepsis and the chances are relatively far greater for failure following a careless or indifferent aseptic technique in this class of surgery than in any other Infection not only spells failure but frequently is lifetaking It almost certainly deprives the patient of future opportunity for a second successful trial This is the real domain of knife and fork surgery

Antiseptic treatment is a preoperative measure while aseptic technique is paramount and must be actuated by mental alertness with a regard for strict cleanliness approaching fanaticism With the hands trained to avoid touching the open wound the operator must forego in this class of work that wealth of information gathered by the educated touch in exploring deep and unseen recesses as is so valuable in abdominal operations Experience in time will soon give the same impulses though diminished in fineness of perception through the grasp of the handle of the knife chisel gouge or elevator Incised margins of skin should be protected and no skin left exposed after incision Every instrument should be regarded as unfit for further use once it is removed from



Fig 7 (at left) Roentgenogram showing complete bony ankylosis of the acetabulum and femur

Fig 8 Roentgenogram showing result of arthrodesis

the wound until it has been boiled Each gauze mop should be discarded from its metal holder as soon as it has wiped the wound one time only The gloved hands should be regarded as a menace if they touch not only the wound but also the part of the instrument which will touch the tissues The thread and needles should be handled with instruments only Every knot can be so securely tied with hemostats as with the fingers and almost as quickly Hemostats should be used invariably for this purpose

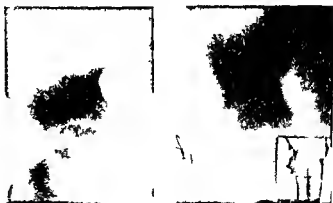


Fig 9

Fig 10

Fig 11

Fig 9 Case 3 Metastatic osteoarthritis of the hip joint with acetabular disease and bulging of the acetabulum The persistent disability

Fig 10 Roentgenogram showing the results of arthrodesis in Case 3

Fig 11 Photograph of the back in Case 3 showing recovery

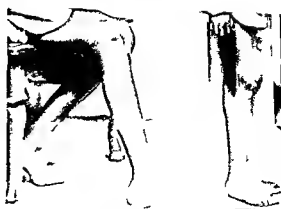
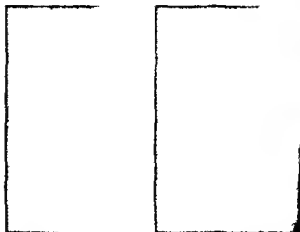


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instead of the finger. Not only the surgeon must be trained technically, but to confidence and hand but his assistant must be equally so.

The work of Carrel, Dakin and associates is carried out in systematic detail is beyond question time and tissue saving. It permits clean work to be done in recently infected wound within a few weeks after instituting the treatment, the microscopic findings of not more than one organism to three fields being the guide in instituting final surgical effort and closed operation in an open discharging through clean wound. The per cent for milium glycerin injection of septic joint after the method of the late J. B. Murphy previous to arthrotic operations is correspondingly efficient in this class of surgery.

In the Vaughan Memorial Clinic the above preliminary treatment in cases of types indicated has been so satisfactory that I have found no occasion to try cut, burn or the aniline dye paste, the latter however because of staining, necrotic tissue in addition to microbicidal properties have a distinct field of usefulness in recently infected wound particularly in bacillary pyoderma aerogenes infections where the removal of all dead tissue is requisite to eliminate spreading cultures of this organism while free and liberal incisions permit drainage. The removal of all focal infection preliminary

to bone joint and tendon operations is a safeguard against wound infection that should never be overlooked and neglected. Wherever and whenever time permit teeth, tonsil, adenoids, sinuses and all possible sources of focal infections are removed prior to operation otherwise they are attended to at the same time the other surgery is done.

Special mention the disadvantage of one-sidedness, exaggerating one estimate or reflex influences or of the relationship of that specialty to the general morbidity existing in the patient under treatment with the result that all disorders of the system are attributed by the specialist to the pathology under treatment by him. Getting into this groove is rather difficult to avoid because we very frequently observe distant and apparently disconnected pains and disabilities disappear after removing some remote disease or deformity. This arises in medicine making fashionable appendectomy, removal of teeth, tonsil, gall bladders and such organs are not essential to life under the supposition that they are harboring focal infections causing reflex nervous or digestive disturbance.

Not to be discounted orthopedic surgery is beginning to include in its special line of work in addition to the gross deformities the obscure deformities and the general morbidity possibly resulting therefrom.

Persistent efforts over long period of time with remuneration far less proportionately

for time and effort expended than in almost any other department of surgical endeavor is to be anticipated. Final results that are worthy of best efforts follow efficiency raised to the highest degree.

Reconstruction operations are the consummation of conservative surgery. All is saved that can be used and all is used that can be saved.

The first three cases in this report are of metastatic osteo arthritis representing varying degrees of destruction of the hip joint. The time lengthened and disease extended. The methods employed in each results obtained and conclusions deduced the reform are given.

**CASE 1.** Mrs. C. White, age 36, married. History of injury to left hip when two years old. At eleven the patient fell and fractured her left leg above the knee. She was in bed for weeks following this injury. She suffered with recurring attacks of pain in the hip. The left leg became shorter. She was thrown from a buggy in 1914 and the left hip was injured. She was operated upon for appendicitis while still suffering from hip. The hip was not treated after injury. The abscess pointed and drained on the inner side of the thigh near the crotch. The septic condition continued and was accompanied with recurring chills. The patient entered the Vaughan Memorial Hospital October 15, 1916. There was a sinus which discharged on the inner side of thigh. Fluctuation was present under the reddened area on the outer aspect of the thigh. The pus was evacuated and a tube inserted into each opening. Culture showed colon bacilli predominating. The Carrel-Dakin treatment was begun and three weeks later the discharge contained not more than one microorganism to three fields. The X-ray showed the trochanter riding three inches above the acetabulum. The head and neck of femur were completely absorbed. The upper third of the femur was diseased. Operation was performed December 18, 1916. Exposure of joint was made through the Murphy goblet incision. The acetabulum and all diseased bone were curetted. The upper third of the shaft of the femur was tunneled. The large pyogenic sac surrounding the joint was curetted. The synovitis of the contracted muscles was divided and the tendon lengthened so that when firm traction was made with pulleys the end of femur was brought on a line with the upper margin of the acetabulum. Ligaments around joint were dissected free including some underlying muscle tissue and this flap was sutured in the upper third of the shaft of the femur completely filling the hiatus made by the chisel and curette. The divided muscles were sutured with catgut and the wound closed without drainage. Dressings and plaster cast were applied using

Fig. 6 (at top) Roentgenogram of Case 5 showing lateral view of fracture of location of the elbow joint.

Fig. 17. Postoperative film of Case 5 showing lateral view of fracture of location of the elbow joint.

Fig. 18. Postoperative film of Case 5 showing lateral view of elbow joint after operation.

canvas and frame overlying orthopedic table. Extension trips of limb were transferred to the pulley of frame thus securing the desired position without moving the patient. After operation the patient and frame being all one piece were removed from the operating room after all adjustments had been made. The wound healed without incident and in three months the patient left the hospital February 19, 1917 wearing a Thomas splint. She is walking with one crutch and has movable hip joint with three inch shortening of limb. She is in splendid physical health. As time goes on she will be able to discard the crutch. The limp is being overcome by elevating the shoe on that side.

**CASE 2.** Mr. I. widow, age 6, came to the Vaughan Memorial Hospital May 1917 to



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This case of unusual interest because it  
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b o n y f u s i o n o f t h e e n t i r e j o i n t w i t h

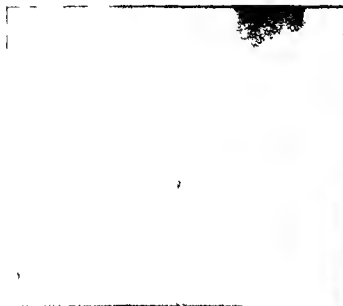


Fig. Case 6. Roentgenogram taken before operation. O test cystica fibrosa. The plate re-attached bone with marked curvature of the upper end of the femur.



Fig. Roentgenogram of Case 6 after operation. The cavities are almost filled with bony material.

destruction of head of femur and consequently poor material with which to form a new and serviceable joint. Added to this the pain status was so firmly established that it is doubtful even with a perfect anatomic result if it will ever be abolished.

Therefore it was decided to do a radical operation and obviate if possible long confinement to bed with only temporary benefit under the most favorable conditions and avoid loss of the essential bony framework necessary in joint reconstruction. On October 9, 1917, arthrodesis was done exposing the joint through a U skin incision. On opening the capsule a brownish fluid with flakes of coagulated fibrin was found filling the joint. After incision of the capsule the head of femur was readily dislocated owing to destruction of its round ligament. All synovium was very red and swollen evidencing the acuteness of the inflammatory process. The acetabulum was deepened and conical in outline. All inflamed synovial surfaces were excised, the acetabulum curetted, returned out and swabbed with a 5 per cent tincture of iodine and dried. A flap of aponeurosis and fat was dried and stitched around the acetabular rim and the head of the femur replaced. The usual steps were followed in completing the operation after Murphy's technique. The patient was placed on a frame with plaster bandage fixation and extension applied. Stock vaccine was continued at two day intervals for two weeks. The highest temperature the first day after operation was 100.102 for two days, 104 fourth and fifth days, 101 sixth and seventh day, steadily declining to normal during the second week. Following this there was no elevation of temperature. The patient

was in bed for two months with no pain on movement. He walked on crutches. There were no limitations of voluntary movement as compared with the right hip. Complete restoration.

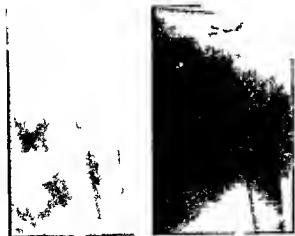
CASE 4. Bony ankylosis from fracture of knee. T. J. colored, age 17, was struck just above the knee by a piece of timber in September 1916. He was treated for fracture of the thigh. He was presented at the Burwell Infirmary January 1917 for stiff knee. He was unable to walk without crutches. There was bony ankylosis of the knee which was bent at an angle of seventy five degrees. The X ray showed a transverse fracture through the lower epiphysis of the femur, the upper fragment was displaced forward impinging against the patella. There was a large callus extending posteriorly two and a half inches upward along the femoral shaft. Operation January 29, 1917. Following the technique of J. B. Murphy the joint was entered through bilateral longitudinal incisions. The patella was freed from the fractured end of the femur with a chisel. A transverse osteotomy of the lower end of the femur was done following the fracture lines and the fracture reduced. A lateral phosphor bronze wire suture was introduced to retain the fractured femoral end in apposition. A small flap of fascia lata was thrown across the denuded of the articular surface of the patella and held in place by chromic catgut sutures on both sides of the patella. The wound was closed with buried suture of chromic catgut and skin suture of silk worm gut. A plaster of Paris bandage was applied over the gauze dressing extending from the crutch to the toes. No extension was necessary for the reason that the articular surface of the femur and tibia were not injured and the slip interposed was not subjected to pressure. The patient made



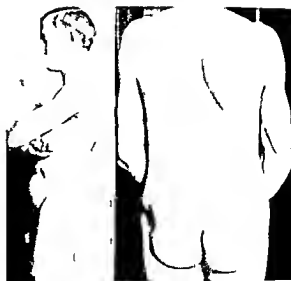


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fall from the house when he was ten years old. Present illness began in 1911 and was accompanied by pain in the sacrolumbar region. He was unable to turn over if lying on his back, he tired easily and had to rest frequently while at work. The x-ray was negative at that time. In 1913, he quit trade of boilermaker and opened a retail grocery at which he suffered less discomfort. He entered the Navy Yard at Philadelphia in 1916 but was unable to stand the work. He came to Montgomery to work at his trade but was forced to give it up. Two months later September 30, 1917, he entered the Vaughan Memorial Hospital on account of pains in back and limbs frequently falling when on his feet and unable to walk any distance. Examination showed lordosis. The spine of the fourth lumbar vertebra was displaced forward forming a decided depressed spine over this vertebra. The x-ray showed displacement and partial destruction of the body of the vertebra. On October 1, 1917, Albee's operation was done interposing a tibial graft between the split spinous processes of all five lumbar vertebrae and the spinous process of sacrum. He was kept on the frame two and a half weeks in bed two months. Recovery was made without incident. His back feel strong and he is anxious to resume work.

CASE 8. Exostosis of humerus. Mr. W. white, age 40, single cigarmaker. Past history negative. Stiff and painful shoulder. Consulted me October 9, 1917, complaining of inability to raise arm and of pain on any movement of shoulder. Tender on palpation over deltoid. Passive movement painful.

No ankylosis. Temperature and pulse normal. No history of injury. X-ray plate showed exostosis near joint situated a half inch from articular surface of upper end of humerus. Operation done October 9, 1917. On chiseling through the base of the growth it was found to be a thin shell of bone filled with a cheesy mass and dipping deep into the shaft of the bone. This was a tubercular infarct. This cavity was thoroughly curetted and filled with a strip of muscle tissue reflected from the deltoid and held in place by a catgut suture. X-ray shows result obtained.

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## TECHNIQUE OF URETEROVESICAL ANASTOMOSIS

BAILEY DAWSON FURNISS, M.D., ILLINOIS, NEW YORK.

From the University of Illinois, Chicago, Ill. (F. D. F.) and the University of Illinois, Chicago, Ill. (B. D. F.).

THIS operation is often indicated but as my article deals only with the technique of the operation no attempt will be made to go into details regarding the conditions under which it is to be done.

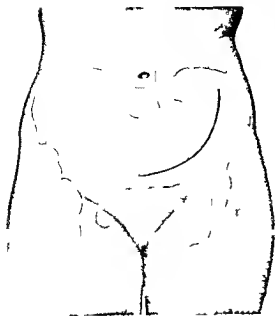
Suffice it to say that it is called for (1) after some operations or labors in which the ureter is injured (2) where in the course of some other operation a deliberate resection of the ureter is made and (3) in certain cases of ureteral obstruction or stricture.

Before attempting such an operation it must be determined that it is technically possible and advisable. If the injury or obstruction is situated so high that a proper anastomosis can not be made it is of course folly to attempt the operation. If as a result of ureteral obstruction or in-

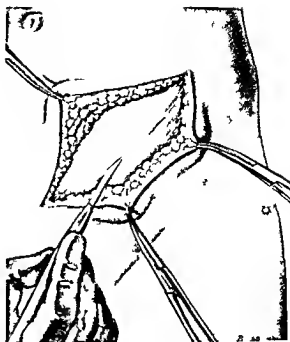
fection the kidney is badly damaged or the combined function of the two is low or there is a recurrence in the pelvis of carcinoma such a procedure is unwarranted.

With our present methods of examination all of the above can be determined and must be before any operation is considered. A successful anastomosis is of no use if the kidney on the side operated upon has no functional value.

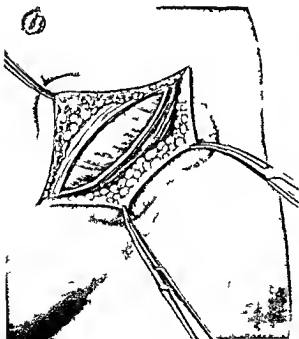
The technique of the operation varies depending upon whether the anastomosis is made at the time of injury to the ureter or as a deliberate procedure for ureteral fistula or obstruction. The actual joining of the ureter to the bladder is the same when the operation is done for operative injury to the ureter, ureterovaginal fistula or stricture or no operative description will be given.



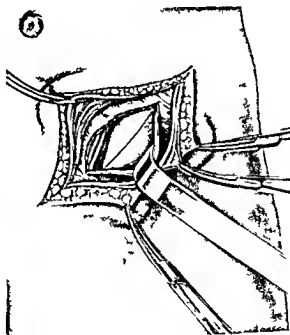
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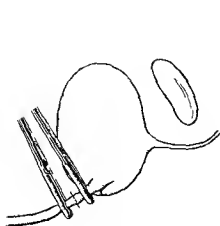


Fig. 5

Fig. 5 The ureter has been double clamped. It is to be divided between the clamp and the caudal portion is tied.

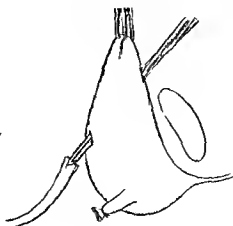


Fig. 6

Fig. 6 Bladder elevated with Allis clamp. Forceps

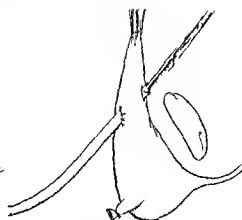


Fig. 7

Fig. 7 The ureter has been drawn through the bladder and united to posterior wall by separate sutures of silk.

The incision which I have found best is a modification of the Pfannenstiel the modification being that it is one sided and prolonged outward and inward to or slightly beyond the median line.

Such an incision begins one inch above the symphysis at the median line (or an inch to the opposite side) and extends in a curved direction upward and outward to a point one inch to the inner side of the anterior superior spinous process of the ilium. The first incision extends down to the aponeurosis of the external oblique; this and the internal oblique are divided in the same general direction as the skin but the curve is flatter. The fibers of the external oblique are really separated but many of the internal oblique fibers are divided obliquely.

This brings the incision down to the transversalis fascia which is so intimately connected with the peritoneum and is often so thin that it is difficult to incise it without opening into the abdominal cavity. This incision is best started with a very sharp knife after the line of cleavage is struck there is no difficulty in separating the transversalis fascia from the peritoneum. Should the peritoneum be opened it is best to establish the line of separation between it and the peritoneum before closing the latter.

After passing through the transversalis fascia by blunt dissection the peritoneum is stripped from the pelvic wall. The large iliac vessels come into view and after the dissection is continued well to their inner side an attempt is made to find the ureter. *This is always to be found in the peritoneal reflection.* In nearly all the cases where this operation is indicated the ureter is much

above normal size and so is the more readily recognized.

After locating the ureter it is lifted upward by applying a pair of Allis clamps in such a way that the teeth meet beyond the ureter itself. The ureter should never be clamped as such an injury may so impair its vitality that necrosis may result. By applying Allis forceps successively lower and lower and at the same time using blunt dissection the lower end of the ureter (or the point of obstruction or the fistula) is reached. Occasionally it is necessary to ligate and divide the uterine artery or the round ligament but usually these can be pushed aside by suitable retractors.

At this stage moderate Trendelenburg elevation is an advantage.

After determining the point of ureteral division the ureter is double clamped and divided. The lower end is ligated with chromic catgut more to prevent troublesome hæmorrhage from a small

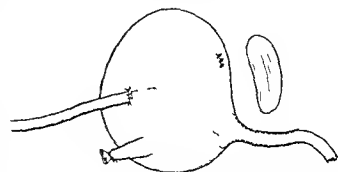


Fig. 8 This shows (1) ligated part (2) ureter entering bladder (3) clamped ureter (4) junction of anterior wall (5) retrocatheter in bladder



BUNION ITS CAUSES AND CURE<sup>1</sup>

By H. A. ROBINSON M.D. KENOSHA WISCONSIN  
C. P. M. D. R. C. P. U. S. A.

**I**N November 1915 I was called to treat the injured foot of a railroad employee. As is my custom in all such cases I took an x-ray to see whether or not there were any fracture. I was rewarded by being able to say positively that there was a fracture of one of the metatarsals. The roentgenogram also showed a peculiar condition which I had never noticed before namely that the sesamoid bones were enlarged. I also observed that the man had a bunion.

Soon after this I treated a foot injury of another railroad man. This man had two very large bunions and while x-raying the injured foot for fracture I had him place the other foot on the plate. Thus I was able to compare the two feet and I found that both showed the same peculiarity as mentioned above. I began to wonder if this peculiarity might not be the long looked for cause of bunion. Later I dissected feet which it had been necessary to amputate. I operated and found that when the sesamoids were removed the bunion was easily reduced and I came to the conclusion that—

Bunion is due to a dislocation of the metatarsophalangeal articulation of the great toe. Contrary to previous theories it is not produced by tight ill fitting shoes with high heels or pointed toes but is caused by pressure from within.

Heredity is a great factor in the development of these deformities. Parents or relatives not far remote who have been so afflicted can be traced in almost all cases. For instance the first patient operated upon by my method had three sisters and two brothers with hallux valgus and their father was a great sufferer from the condition. The next patient operated upon said that her father died when she was a little girl but she remembered that his feet were like hers. I could enumerate many cases to strengthen this theory but it is an easy matter for any who wish to investigate for themselves to find further examples.

Dwight has described a supernumerary bone which occasionally exists between the bases of the first and second metatarsal and to this bone he has given the name of intermetatarsum. J. K. Young believes that Dwight's bone is the cause of some cases of hallux valgus and that its early removal arrests the condition and relieves all symptoms.

I shall consider only two forms of bunion. First the usual type which develops on the inner side of the great toe joint (and by inner and outer I refer to the foot with reference to the middle line of the body and not the median line of the foot). In this form of bunion the head of the metatarsal bone is displaced inward. In the second form the head of the metatarsal bone is displaced upward and there results a bunion on top of the foot. The cause is the same in each case and the only difference is the direction from which the villain attacks the innocent unsuspecting first metatarsal bone.

The onset is very insidious and the patient is unaware of his predicament until the joint is considerably enlarged and the foot swollen and painful. Then in looking for a cause he invariably blames the shoe for an offense of which it is entirely innocent. Many times the shoes are discarded and new ones take their place. The patient tells the shoe fitter that the old shoes were too tight across the ball of the foot and suggests a size wider. This relieves for only a short time because the head of the metatarsal continues to spread and soon a size larger is needed. This process is continued until the feet are unsightly when a chiropodist is consulted. He again blames the shoe for the trouble and tries all sorts of apparatus for the relief of the deformity. Yet it stays and this is not surprising since we believe we know what causes the trouble.



I. X. Roentgenogram of normal foot

Received by the Kenosha City Medical Society July 9, 1918



Fig. 3. The first metatarsal bone inward toward the median line of the body how could a tight shoe produce it.

I can show numerous cases with enormous bunion and almost complete dislocation of the joint who never wear a tight shoe then too I can show a great many people who have worn very tight shoes all their lives and who have no sign of bunion.

Some contend that high heels are a frequent cause but many people who have worn high heels more or less all their lives have no bunion. Pointed toe shoes are a more local cause but again I can show people who have worn pointed toe shoes all their lives yet they have no bunion.

In all cases of bunion large or small whether they have worn tight pointed toe shoes high heels or broad room shoes there is one thing

in common which I claim to be the cause namely enlarged sesamoid.

I will endeavor to explain how the bunion on the inner side of the foot develops.

The two sesamoids which develop normally under the head of the first metatarsal bone enlarge and grow downward and outward toward the head of the second metatarsal and as the plantar fascia is tough it resists the sesamoid and with each step pushes them upward and inward and causes the head of the metatarsal to give in the line of least resistance which is upward and inward.

Because there is no pressure inward on the proximal phalanx of the great toe it is held firmly by the strong ligaments and gradually the head of the metatarsal is displaced inward. This turns the great toe outward toward the other foot until in many cases the head is almost completely dislocated from the articular surface of the phalanx. The roentgenograms show that this dislocation corresponds to the size of the sesamoid.

Bunion occurs on top of the foot when the sesamoids are enlarged and point straight downward toward the sole of the foot. The tough plantar fascia forces the sesamoid upward again toward the head of the metatarsal so as to displace it perpendicularly upward and the phalanx being held firmly to the tendon is not displaced. This produces a bunion on top of the foot. The cure in both cases is the same namely removal of both sesamoids.

By way of preventing surgery I would advise the removal of both sesamoids as soon as the first symptom of bunion are discovered which



Fig. 3. The first metatarsal bone inward toward the median line of the body how could a tight shoe produce it.

I can show numerous cases with enormous bunion and almost complete dislocation of the joint who never wear a tight shoe then too I can show a great many people who have worn very tight shoes all their lives and who have no sign of bunion.

Some contend that high heels are a frequent cause but many people who have worn high heels more or less all their lives have no bunion. Pointed toe shoes are a more local cause but again I can show people who have worn pointed toe shoes all their lives yet they have no bunion. In all cases of bunion large or small whether they have worn tight pointed toe shoes high heels or broad room shoes there is one thing in common which I claim to be the cause namely enlarged sesamoid.

I will endeavor to explain how the bunion on the inner side of the foot develops. The two sesamoids which develop normally under the head of the first metatarsal bone enlarge and grow downward and outward toward the head of the second metatarsal and as the plantar fascia is tough it resists the sesamoid and with each step pushes them upward and inward and causes the head of the metatarsal to give in the line of least resistance which is upward and inward.

Because there is no pressure inward on the proximal phalanx of the great toe it is held firmly by the strong ligaments and gradually the head of the metatarsal is displaced inward. This turns the great toe outward toward the other foot until in many cases the head is almost completely dislocated from the articular surface of the phalanx. The roentgenograms show that this dislocation corresponds to the size of the sesamoid.

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By way of preventing surgery I would advise the removal of both sesamoids as soon as the first symptom of bunion are discovered which

can be readily done by the X ray. Then no further development can take place and the patient will be spared the hideous disfigurement of the feet as well as the suffering which eventually comes if operation is delayed.

To remove the sesamoids, an incision is made commencing at about the under surface of the head of the metatarsal and one half to three fourths of an inch back of the protuberance. The prominence is encircled to a point a short distance in front of the joint and on the phalanx and the flap reflected downward leaving the bursa intact. Then if there are any sharp points or prominences on the inner side of the head the

bursa is reflected forward on the phalanx and the prominences removed with a sharp chisel. After removing the sesamoids the bursa is replaced over the denuded bone and sutured to the periosteum. The head of the metatarsal can be easily replaced and the toe will come around into position. Then the outer flap is sutured after introducing a small silkworm drain and the wound dressed. It is a good plan to put a small wood splint on the inside of the foot and to bind the great toe to it and to bandage the foot tightly. When the foot is healed a good snug or even tight shoe will be comfortable to the patient.

## CRANIAL DECOMPRESSION FOR HEAD INJURIES ACCOMPANIED BY SIGNS OF INCREASED INTRACRANIAL PRESSURE<sup>1</sup>

BY R. L. PAYNE, JR., M.D.  
S. G. ST. V.

FACS, NORFOLK, VIRGINIA  
U. Hospital

SINCE 1909 I have written several papers on the subject of fracture of the base of the skull reporting some of my work and recommending that temporal decompression be always done whenever these cases develop a certain degree of increased intracranial pressure.

From that time up to the present I have been astonished at the indifference many doctors show, especially those doing and seeing little surgery to this subject of severe head injuries and I wish to report again my small experience in this work.

In considering the value and advisability of subtemporal decompression in skull and brain injuries the burden of proof would naturally fall on the results obtained with and without operation in a given series of skull fractures. Unfortunately up to the present time these statistics have been based on the total number of fracture cases coming under a given surgeon's experience and I here wish to express the view that such deductions are erroneous and do not permit of truthful conclusions.

I think we all agree that all demonstrable depressed fractures and those showing focal symptoms need some operative treatment and with this type eliminated there is then left two distinct varieties of head injuries, namely, mild and severe in which the classification depends entirely on the surgeon's ability to determine whether there is or is not a marked increase of intracranial

pressure. In the mild type the intracranial pressure is slightly raised, soon returns to normal and there is no necessity for an operation but the question of subtemporal decompression in these cases depends largely on the accurate determination of just what the intracranial pressure is doing. The very fact that this determination can be definitely carried out at once places these mild cases beyond possible operative interference and therefore should eliminate them from statistics presented with the view of estimating the value of subtemporal decompression in head injuries.

It is only in the severe types of head injuries with marked increase of pressure that decompression should be considered and therefore the severe variety alone should be included in records collected for the purpose of determining the value of subtemporal decompression in these cases. On the other hand many of these severe head injuries suffer profound shock and such severe damage to the medulla that death occurs at once or in a few hours. These cases therefore never come within the realm of an operative possibility and hence should not be considered in our statistics.

I think we might say approximately that any severe head injury lying eight hours after injury should be considered an operative possibility and studied carefully with the view of determining whether a decompression should be done.



Many cases however recover from the initial shock within the first one or two hours and in these instances investigation of the various clinical sign of increased pressure should be started at once. When the increase in intracranial pressure rises definitely high one can never tell how soon the fatal stage of medullary collapse may occur therefore if operation is indicated it should be done as early as possible.

The greatest mistake now made in the treatment of these cases is that of waiting too long when operation is indicated. Some of the operative deaths have undoubtedly been due to interference before recovery from the initial shock but the greatest error made in these cases and the hardest to avoid is that of delay when once the intracranial pressure has reached a high degree. This brings us to the consideration of what are the indications for subtemporal decompression in these cases.

If a patient sustaining a head injury does not die within the first few hours there is first recovery from the initial shock the blood pressure gradually rises to about normal and then the signs of increased intracranial pressure may be studied for the first time. The signs are to be found in the pulse rate the eye ground the spinal pressure and the systemic blood pressure. The pulse rate and general blood pressure should be recorded every thirty minutes the eye ground examined every hour and the spinal pressure estimated one or more times according to the indication for or against the procedure.

If there is an extremely high rapid rise in intracranial pressure there will quickly develop medullary compression with oedema and in this state we will have a fast increase in pulse rate a fall in blood pressure negative eye ground and a low spinal pressure. It is needless to say that this is the fatal state and any operation undertaken in this stage would only hasten the end. If the rise in intracranial pressure is slow but gradually increasing there will occur a slowing of the pulse engorgement of the retinal veins and a rise in both the systemic blood and spinal pressure.

Some surgeons do not attach much importance to the question of blood pressure and in this connection it is to be recorded that we do not get an increase in blood pressure until the rise in intracranial pressure equal that of the general circulation. Irritation or stimulation of the vaso-motor centers then occurs the general blood pressure rises a step of from five to fifteen millimeters and is simply nature's method of overcoming medullary anæmia. There is never an

increased blood pressure early when associated with only a mild increase of intracranial pressure. I have found that blood pressure readings are often of material value and once this pressure has risen high and begins to fall an operation in my experience has always been futile.

When the intracranial pressure attains sufficient height the return flow in the retinal veins is obstructed with a resultant dilatation and if the condition progresses there will occur first an obscuration of the nasal half of the eye ground and later a total blurring will develop. This sign will often be found in only one eye as several of my cases have shown.

In considering the four cardinal signs of increased intracranial pressure I feel that the change in pulse rate is not only the most readily observed but the most dependable symptom in our present knowledge. This is probably due to the fact that of the three vital centers in the medulla the vagus is not only the most stable but responds more rapidly to stimulation. When a pulse of 80 or more gradually falls to 60 we should strongly consider a relief of the intracranial pressure. A greater drop to 55 or 50 coupled with retinal oedema and a rise of the blood and spinal pressure is positive indication for an immediate decompression.

The value of spinal pressure estimation in the acute cases is sometimes valuable but oftentimes dangerous. It should never be done when there is a high blood pressure or during the stage of marked increase in intracranial pressure. Several deaths have been reported following this mistake. The procedure is probably of more value in subacute and chronic cases and should only be utilized early in the acute cases before there is a decided rise in intracranial pressure.

It is a mistake to wait in the cases for a development of all the signs of increased pressure before operation is undertaken. Experience after all is the best guide and watching some of these cases will teach a surgeon to decide upon operation when only two of the cardinal signs are present. For instance a pulse of 50 coupled with partial optic oedema or a pulse of 50 coupled with a rise in spinal pressure to 20 millimeters on a mercurial manometer or a slow pulse a rising blood pressure of two steps coupled with either optic oedema or increased spinal pressure are entirely sufficient to warrant operation.

In grave cases with very high intracranial pressure unrelieved by decompression there will occur sooner or later an exhaustion of the vaso-motor and vagus centers. This is indicated by

a rapidly rising pulse rate and a falling blood pressure and invariably means medullary oedema and approaching medullary collapse. These symptoms following a previously slow pulse and high blood pressure in such a case are therefore positive contra indications for operation. I have never seen a case of acute high intracranial pressure with a pulse of 45 to 50 recover by operation if the case was left unoperated until the pulse on the secondary rise had reached ninety five. If there is any hesitation whether operation should be done in a case showing the cardinal signs of a high increase in intracranial pressure this doubt can be at once dispelled if the pulse rate suddenly increases fifteen to twenty beats.

Textbooks quote the mortality of basal fractures from 50 to 90 per cent. The most reliable data in print today is from William Sharpe. Carefully analyzing his reports<sup>1</sup> would permit one to arrive at the following deductions:

From first report to June 1, 1914

Fifty seven cases possible for operation but not necessarily indicated

	N	mbe	C	P
Cases not operated upon	21			
Recovered	3		14	
Died	18		85	
Cases operated upon	36			
Recovered	27		7	
Died	9		25	
Cases possible for operation	86			
Cases not operated—all died	1			
Cases operated	75			
Recovered	54		72	
Died	21		8	

In arriving at these deductions from Sharpe's cases we have eliminated as previously mentioned in this paper those cases having only a slight temporary rise in intracranial pressure and the moribund head injuries dying a few hours after admission. Certainly these two types would never

come within the realm of an operative possibility and therefore should be excluded from statistics bearing on the value of the operative procedure. For the same reason I herewith report my experience with 29 head injuries accompanied by signs of high intracranial pressure in which the operation of subtemporal decompression was done on every case.

Twenty two or 75.86 per cent of these cases recovered while seven or 4.14 per cent died. Some of the deaths in my cases occurring in my earlier experience were undoubtedly due to delay in operating until medullary oedema had begun. In my last seven successive cases chosen for operation there has been only one death following decompression.

In considering statistics there is further chance for error as follows. First because the patient died without operation that therefore he would have lived if operation had been performed. Second we say a series of cases might be possible for operation this is tentative depending on their condition and certainly does not mean that operation is indicated in all of them. Third I do not think that any surgeon can assume just because operation resulted in recovery that therefore the patient would have died without operation.

Some of these high pressure cases occasionally recover without operation but practically all of them have to reckon afterward with post-traumatic brain and general nervous symptoms which it is reasonable to believe would have been forestalled by a timely unilateral or bilateral decompression.

In view of the operative recoveries reported and the absence of post-traumatic symptoms following a timely decompression I again take the position that our results will be much better in these cases if with the proper indications present we help relieve the threatened danger to the medulla and rest of the brain by a cranial decompression.

## A NEW OPERATION FOR THE CURE OF FEMORAL HERNIA

B. J. W. DOWDEN, F.R.C.S. (E.) L.D.S. (L.S.)  
 Surgeon to the Edinburgh Royal Infirmary

ALMOST every surgeon will agree that the radical operation for the so-called cure of femoral hernia is an unfortunate recurrence, humiliating, and not at all uncommon. Various operations have been carried out with more or less satisfaction. The operation described below has been performed by me on a great many patients during the past year in my ward of the Edinburgh Royal Infirmary. In sufficient time has not yet elapsed for the result in the latter case accurately to be estimated. If the following paper elucidates sufficiently my method, readers will probably agree that there ought to be no failures. The cause of failure in the ordinary operation are due to the rigid wall around the femoral ring, which are not amenable to sound and reliable approximation.

The principle of my operation is the placing of a ball of fat or other tissue bigger than the abdominal aperture of the femoral ring, and fixing the ball in the ligated sac of the hernia being displaced above the ball. The result is that the greater the intra-abdominal pressure the more the ball is forced against the femoral ring thus effectually closing it. All peritoneal ligaments the neck of the sac only or by placing it upward are liable to recurrence. Reduction of the inguinal ligament (Poupart) and the inguinal ligament (Poupart) and the inguinal ligament cannot always be carried out. Nicoll's (Chloroform) board hole in the pubic bone and approach to the inguinal ligament by a slit in the skin which has passed through the abdominal wall and the inguinal ligament in the hope of a mitre effect.

Baldwin's method and MacFey's method most closely approach mine. Both utilize the sac to form a buffer and the external oblique muscle method. My method is simply a more certain buffer and even if the buffer is converted into fibrous tissue it will be effectual.

*Dissection of the hernia.* An incision about 4 inches long is made a little below and parallel to the inguinal ligament (Poupart) with the center over the site of the hernia. The fatty coverings of the sac are exposed and by gauze dissection and with scissors easily cleared up to the femoral ring. Not only should they be cleared to the ring but with a blunt dissector or Mayo's scissor cleared from the femoral ring, a well. As a rule by pulling on the fatty covering and

the sac this can easily be done. The fatty covering are often quite thick as will be found on clipping, through them in order to open the sac which should now be done and a careful search made for the adherent omentum or other structures. Redundant and adherent omentum if too large to replace is ligated and cut off. This excised portion is carefully preserved either in a corner of the wound or in warm normal saline solution. The next stage of the operation is to revert to the skin and fascial incision. The upper margin of the incision is dissected still further upward exposing the inguinal ligament and the aponeurosis of the external oblique for half an inch or more (depending on obesity) above the inguinal ligament. An incision is now made through the external oblique aponeurosis about a quarter of an inch above the inguinal ligament and extending from the pubic spine for one inch or more upward and outward parallel to the inguinal ligament. This incision opens the inguinal canal and the cord or round ligament must be displaced inward. Forceps are placed in the edge of the external oblique aponeurosis for the purpose of suturing at the termination of the operation. The transversalis fascia is next incised through the incision but care must be a light touch not to carry the incision too far out lest the inferior (ileo) peritoneal artery or its accompanying vein be injured. The extraperitoneal fat of varying density is now exposed and the abdominal aperture of the femoral ring is sought. We have the incision and pass to the lower. The abundant fatty covering has been defined. By following the size of the femoral ring it is judged whether the sac and its covering can be pushed from the thigh to the abdominal side of the ring in its entirety or two halves pushed up separately. Either grasping the sac with curved forceps from below and pushing the curved forceps through the ring with the sac or else passing from above a pair of curved forceps and seizing the sac does not matter very much provided the sac and its covering are displaced and pulled out through the upper incision. If the sac and coverings are too large they should without any hesitation be cut off and carefully kept as the portion of omentum to be utilized later. The remainder of the sac are then easily displaced upward. If for instance the sac and its

coverings have been brought out through the upper incision the neck of the sac is transfixed with catgut on a needle and firmly sutured. The ends of the ligated catgut are left long so as to identify the neck of the sac if required. Now a ball valve is to be made. If the sac and its fatty coverings have been transferred to the abdominal aspect of the femoral ring it is judged by the size of the ring whether the bunched up sac and coverings will form a ball about half as big again as the abdominal opening of the ring. If so a needle and catgut are utilized to stitch the sac across and about in various directions until a ball is formed and the last stitch being through the part which will form the lower surface of the ball. These stitches should not be pulled too tightly and the primary end and terminal end of catgut used should be left long. A pair of curved forceps or Cleveland needle is passed from the lower opening through the femoral ring to the abdominal aspect and the two ends of this catgut stitch left from forming the ball are grasped and withdrawn on to the thigh. One of these free ends of catgut is now threaded on to a sharp needle and passed through securing a good hold of the pectineal fascia. The needle is now removed and the two ends of catgut which have passed through the femoral ring are knotted firmly together. This is done with the object of snugly pulling the ball valve down on the abdominal aspect of the femoral ring. The ends of catgut on the neck of the sac are now cut off and the transversalis fascia and external oblique aponeurosis sutured. An appendix inverter or pair of fine dissecting forceps may be required to push the ball valve out of the line of this suture.

If this sac does not form a satisfactory ball or if the sac has had to be cut away to enable the transposition of the hernial neck to the abdomi-

nal side of the ring excised omentum or sac coverings can be utilized separately to form a sufficiently large ball. If these are insufficient it is usually possible to obtain as much fatty tissue as is necessary from the abdominal wall or from the thigh. The deep layers of the incision are now sewed together and the skin wound approximated. The only case that I have had trouble in was one in which one of the inferior (deep) epigastric veins was injured.

The operation for the first time seems to the operator somewhat tricky and a little difficult when dealing with the incision on the abdominal side of the inguinal ligament but with a little practice and the help of small retractors this is overcome. In fact one can look down on the femoral ring from the abdominal side and see the arrangement of the blood vessels about it.

When dealing with a strangulated femoral hernia the incision above the inguinal ligament is of great help because not only does it enable the surgeon more easily to reduce the hernia but also allows free inspection of the constricted area of intestine. The sac having been opened and the condition of the gut considered the second incision carried out above the inguinal ligament is then made. The peritoneum is opened and the entering portions of intestine are drawn out through the upper wound and by means of gentle traction of first one portion and then the other associated with gentle taxis of the obstructed intestine in the sac below the ligament is followed usually by an easy reduction and the coil can then be drawn out of the upper incision and examined in its entirety. The radical operation as described can then be carried out in the majority of cases. There is more difficulty in operating on hernias recurring from other methods as the sac is adherent to the femoral ring.

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING MARCH 1 1915 DR CARL BECK PRESIDENT IN THE CHAIR

### ELECTRIC LIGHT AND HEAT IN THE TREATMENT OF INFECTIONS

DR A J OHSNER read paper on the value of the electric light and heat in the treatment of septic condition (see p 328)

#### DISCUSSION

DR WILLIAM M HARSHBAUGH I would like to ask Dr Ohsner to refer to the candle

DR OHSNER We use lights of different candle power although we usually use a 3 candle power light

DR E M SALA Do you ever get any burn from these lights?

DR OHSNER No If the Burdick light which we prefer is too hot the patient can press a button which along side of him which will reduce the heat to one half the original length

DR SALA How long do you continue the treatment?

DR OHSNER Some patients will have the light on all night but others will use it for one or two hour intervals

DR CARL BECK Since Dr Ohsner called my attention to this method of treatment we have used it in our hospital frequently and have been very well satisfied with the result

Sunlight is the best remedy as discussed by me freely within the last few years Most of us are familiar with the experiment of Rollier and his experience I became so much interested in the subject that I visited Rollier at Leysin and I may say that I was amply repaid for my trip there I saw hundreds of patients who were being treated with light therapy Rollier has not only resorted to this method of treatment in chronic inflammatory changes of a tubercular nature but also in cases of septic infection

I might mention a little history in connection with the circumstance which led Rollier to take up heliotherapy He was an assistant in Kocher's clinic in Switzerland In the clinic there were a number of cases of septic infections in which the wounds would not heal in the dark rooms of the hospital to which no sunlight found its way Rollier's wife was afflicted with tuberculosis He moved up to the mountains of Switzerland for a while and while there noticed a case of extensive injury in

an ill man who as a cure got himself lying in the sun He assured Rollier that his sores were healing without any medicine or without doctor This gave Rollier his first thought of light therapy in chronic inflammatory change and he began to bring him to the clinic of surgical tuberculosis and cases of other diseases to the mountains and expose them to the sunlight and he built on a sanatorium after another until today there are thousands of patients at the sanatorium Shortly after this they began to use artificial sunlight in the shape of sunlight lamps You are doubtless all familiar with the Kromayer lamp and with other lamps and patients have done well under the treatment of the lamps but in none of the treatment has attention been called to the action of the light or heat on pain and how easily pain can be relieved by the action of the artificial light which Dr Ohsner has called our attention to light It is much better to use the light than to employ narcotics which are only of temporary use while these lamps or light can be used permanently Interesting at the same time is the explanation of Rollier and Bernhard of the physiological effect of the lamp light and other lights upon the skin Their explanation is that it stimulates a local leucocytosis They have made many experiments in Rollier's clinic in regard to this and have found changes in the red blood corpuscles shortly after exposure to sunlight and after other light have been used

DR THOMAS J SULLIVAN We all know very well the value of heat in treating infection of the hand I have had considerable experience with the use of electric light as a heat factor in handling septic cases acquired in the packing industry Some of the cases are very bad and yet healing takes place very quickly by the use of electric light in association with large hot boracic acid dressing A new epoch in surgery was reached when boracic acid dressings and heat were used for septic conditions of the hand

Some one has recommended the use of the Kromayer lamp in the treatment of tuberculous glands of the neck The Kromayer light will burn the tissues unless care is used in its application In focusing the light one should cover the surrounding tissue with cotton having a properly arranged hole cut in the paper If this precaution is not taken you will burn the skin I have used this method in cases of tuberculous glands of the neck and girl

particularly where in operation for cervical adenitis was not desirable and have been able to limit the size of these glands rapidly by the application of heat. A frequent handicap however is the unwillingness of these patients to come to the office for treatment but the result of the treatment is well worth the frequency of the application.

Heliotherapy is a rediscovery of a very old treatment of infections. In this short discussion we may eliminate a review of its use but instead mention that it was used and described by Herodotus in 484 B. C. Last summer I made use of it in a case of bilateral tuberculosis of the calcanei.

The patient did better on the roof of the hospital in the hot sun than he did in the surgical ward. The exposure was gradual until he remained four to five hours in the sun every available day. Judging from the result of healing of the calcanei I can endorse this method of treatment from personal experience.

DR. EMIL G. BECK: I would like to ask Dr. Ochsner if this method of applying heat has been used in cases of acute articular rheumatism in his hospital.

DR. OCHSNER: It has been used in acute articular rheumatism also in gonorrheal rheumatism. The Trust Company of this city have these lamps for rent. If one has a patient in a private house with tuberculous glands of the neck or with septic infection he can rent one of these lamps for \$2.00 a month. The lamp can be attached to any electric light and used in that way. It is much more convenient to rent these lamps than to buy them for individual patients. We make use of these lamps in any case of local pain no matter where it is or what the cause of it is. I think probably the leucocytosis or the congestion brought about by the use of the heat is what relieves the pain. There is no doubt but what heat produced by light is more penetrating than heat supplied in any other way.

DR. CHARLES DAVISON: I would like to hear Dr. Meyer of the County Hospital speak on this subject.

DR. KARL A. MEYER: Dr. Fantus of the Therapeutic Department of the University of Illinois who is doing work with light treatment last year came to the hospital and asked me if he could avail himself of the clinical material to treat a series of cases with electric light treatment. The first series he treated with electric light were cases of gonorrheal rheumatism. He treated I think so case with excellent results. These are the most intractable cases we have to deal with in the hospital. In our work on the prostate gland we have used large doses of vaccines intravenously with terrific reactions but after treating these cases with electric baths during their stay in the hospital the relief from pain has been remarkable. This treatment is used at the Cook County Hospital in treating nephritic cases for six days and we find it is much easier on the nurses. We have seven or eight of the apparatus in the medical wards. The medical men are availing

themselves of this therapeutic adjunct very extensively. We not only use them in the general medical wards but in the venereal wards. This treatment is also used by Dr. Brown and Dr. Suker in cases of iritis with terrific pain and in all sinus infections of the nose and throat.

DR. EMANUEL FRIEND: We are using at the Michael Reese Hospital an apparatus which produces a therapeutic effect similar to these lamp lights exhibited by Dr. Ochsner. It is an electric apparatus allied to the ordinary hair dryer. I do not know whether any of the gentlemen present have used it but we are using it in chronic joint troubles with very good results.

It seems to me the rationale of this treatment is the skin hyperemia which relieves the deep stasis or congestion of the lymph vessels and the blood vessels. In cases of chronic arthritis we have had very good results from this hot air apparatus. I believe this so called hair dryer is a little more convenient than the lamps would be.

#### BRACHIOPLEXUS PARALYSIS DUE TO ANEURISM OF THE AXILLARY ARTERY

DR. PAUL MORF reported a case of brachioplexus paralysis due to aneurism of the axillary artery.

#### NEW OPERATION FOR PROLAPSE OF THE UTERUS

DR. CLIFFORD U. COLLINS of Peoria, Illinois described a new operation for prolapse of the uterus (see p. 36).

#### DISCUSSION

DR. ALBERT GOLDSPOHN: The operation that has been described by Dr. Collins is commendable in the first place because it is a vote against the stultifying *interposition operation* first introduced by Schauta followed by Wertheim and then by Watkins of our city. The objection to that procedure is this: that while these are mostly old women and therefore are less exposed to infection than younger women yet they are in the world and they are not beyond the reach of infection and if a uterus so turned into that abnormal position and incarcerated above the anterior vaginal wall should become infected as it can as well as through the vagina then it will be a true *noli me tangere*. Nothing can be done with that except extirpation and that would be a difficult and mutilating procedure.

An advantage of the Collins procedure is that it makes a good firm suspension of the uterus above which is one of the two fundamental things needed. The same thing is done by the Murphy suggestion. But neither the Murphy technique nor this technique is necessary in many instances because most of these uteri are small. In this country we deal with this condition in women beyond the childbearing period mostly. It is not necessary to remove the body of the uterus wholly



# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE REPAIR OF LARGE GAPS IN PERIPHERAL NERVES BY NEUROPLASTY<sup>1</sup>

BY KENNETH A. J. MACKENZIE MD FACS PORTLAND OREGON

WHILE a great volume of scientific work has been done in the field of neurological surgery especially in the realm of the brain and spinal cord relatively little has been done in the surgery of the peripheral nerves. This branch however looms very largely in the great war that is now raging in Europe and countless thousands of injuries of the kind are taking place.

A wealth of experience in this as in all branches of surgery will doubtless bring about adjustment of many unsettled problems and throw a flood of light on such highly specialized branches as those of the nervous system. Observations of the reports made by many commentators in this field of surgery since the war began and during its progress convinces one that up to the present time the main work has been to assemble the material and the practical experience. At a later period after the strife is over the material will be sifted and delivered to the world literature.

It is observed that on the field and in the hospital surgeons seem to adhere to more or less stereotyped methods of treatment in vogue in the past. There is even a disposition on the part of surgeons in high places to discard methods of treatment that have been proved to be successful. Thus the transplant whether the auto the homo or the hetero variety is decried as useless and the method

advocated in this study for selected cases is given no place at all. Experience even in a very limited degree which is the lot of most general surgeons who after all must deal with a great many of these cases must be evaluated with the experience of any other group.

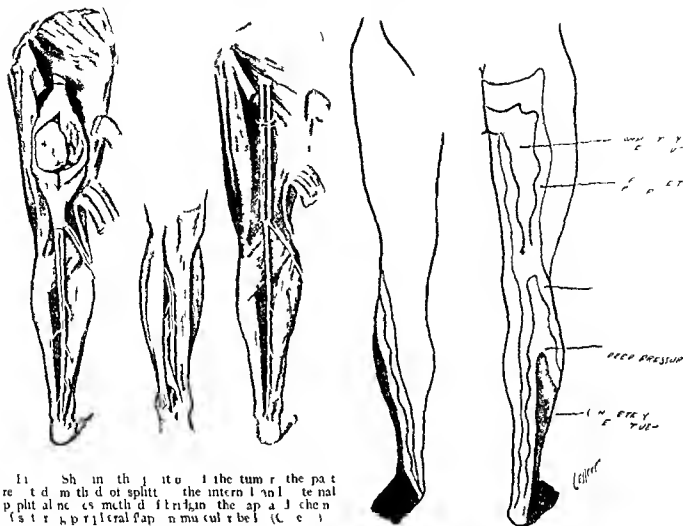
The object of this study is to present three cases which embody certain variant principles of treatment and in which very satisfactory results have been attained. In point of fact under no other method of treatment known to the writer could relief have been attained and for that reason they possess a certain intrinsic value. The three cases submitted illustrate the utilization of nerve flaps of both central and peripheral origin in order to bridge unusually large gaps in peripheral nerves.

The first case is the outline of one presented to the American Surgical Association in Philadelphia in June 1909 the man having been brought to the scene of the meeting and exhibited.

G. E. C. developed in 1888 molluscum fibrosum the tumor varying in size from a millet seed to a walnut and disseminated over the trunk head and extremities. In 1898 one of the tumors developed rapid growth in the right arm above the inner condyle of the humerus. After its removal local paralysis in the hand succeeded but passed away within six months. In May 1907 a slight swelling was observed on the posterior mid region of the right thigh which was painful and sensitive. After a direct injury sustained in December the tumor developed rapid growth. The slightest pressure







11. Sh. in th. i. t. u. of the tumor the patient divided the internal popliteal nerve into three parts (a) the proximal part (b) the middle part (c) the distal part

branches. The division and fitting of this flap was continued upward to within half an inch of the divided end of the internal popliteal nerve. This flap was sixteen and three quarter inches in length and its diameter was less than half the diameter of the nerve. Its end was implanted in a slit made in the stump of the sciatic nerve and held by two very tender chrome sutures. The filament was not more than a line and a half in diameter and contained four or five nerve fibers. It was handled with the utmost tenderness and buried from end to end by suture overlapping the underlying muscle, the motive being to avoid its destruction by scar formation and to permit the neuroization of the muscle of the leg. The wound was then sutured in place and the entire length of the cutaneous incision closed by a subcuticular iodized catgut suture. The leg was invested in a plaster cast adjusted to the leg and thigh at an angle of 130°. The first dressing made on the tenth day found the wound united throughout by first intention.

Examination of the leg revealed but one chronic and it was very striking the evidence of trophic disturbance were largely swept away and the leg now presented a much improved appearance.

Believing now that if the transplantation of a

11. 3. Zone of disturbed conductivity in case

feverer split from one popliteal would do good by establishing conductivity and promoting regeneration that a few more fibers might augment the benefits a third operation was performed on April 1908 67 days after the first operation and 46 days after the second. In the intervals the limb was treated daily by massage and electricity.

The third operation consisted of an attempt to split the external popliteal nerve and utilize a flap in the same manner. This was a more difficult procedure but a flap of the same length was finally lifted up and tucked in a separate muscular bed on the outer side of the other branch its end implanted into a cleft previously cut in the stump of the sciatic nerve. It was noted in this dissection that little or no scar tissue had formed in the line of the first transplantation. The wound was closed in the same manner and united by first intention. A few weeks after the cast was removed and an adjustable splint applied which permitted the leg very gradually to be extended to a straight line. Thereafter treatment by massage and electricity was instituted and continued up to the time of his discharge (Fig. 12).

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ten or of the foot namely tibial posticu flexor longu digitorum the flexor lon u halluci were similarly involved and likewise the peroneal group and all the group of muller muscles of the foot

Previous to this operation it was held doubtful that regeneration could take place when the substance of the nerve is lost over a spread of two inches or more. Here a spread of ten and three quarter inches was made and the entire trunk of the sciatic eliminated. The theory has been held for a number of years past that regeneration can only take place from the central end of a nerve and more recent studies would tend to confirm this principle.

That regeneration on a colosal scale can take place and has taken place under condition in which flaps taken from the peripheral end of a divided nerve and utilized to bridge a gap ten and three quarter inches in length and fixed to the central end of the divided nerve and that they were successful in restoring motion and power to muscle completely paralyzed by the traumatic infarct in view of the result obtained in this case and listed as follows (1) Trophic recovery is practically complete (2) There has been recovery in a limited degree of protopathic and epieritic sensibility (3) There is almost universal recovery of deep sensation (4) Recovery has taken place of motion and power in group of muscle which after the excision of the nerve were reduced to a hopelessly paralytic state (a) the flexor group in the thigh viz complete recovery of the emmembrinuous emtendinuous and the biceps (b) the flexor group in the leg viz the gastrocnemius plantaris soleus and popliteus. Extensive recovery has taken place in this group which has been progressive (c) the flexor and extensor in the phalanges and foot. Minute examination of the muscles show them to be strong and capable of contracting and while they do not move the foot they control it and there is but little tendency to foot drop. Some of the muscle of this group now show only partial reaction of degeneration (5) The relatively small and contracted area of absolute cutaneous analgesia (6) The rela

Analysis of the effect of the injury. The excision of the entire nerve *in toto* predicated the elimination of all motor and sensory transmission throughout the area supplied by the sciatic nerve and its derivative. The nerve was divided at the level of the gluteus maximus and the first branch delivered to the hip joint was probably untouched. The muscular branches distributed to the flexor of the leg namely the biceps and emmembranosus and emtendinosus and the branch to the adductor magnus were divided. These muscles afterwards wasted and showed a state of flaccid atrophy. The area of cutaneous sensory distribution was entirely cut out. In addition to the hamstring group of muscle already mentioned the muscle supplied by the internal popliteal nerve namely the gastrocnemius plantaris oleus and popliteus were deprived entirely of their nerve supply and wasted rapidly. It showed the reaction of degeneration. The flexors of the foot tibialis anticus the extensor longus digitorum extensor longus hallucis and peroneus tertius were shorn of their nerve supply and underwent the same paralytic changes. The ex

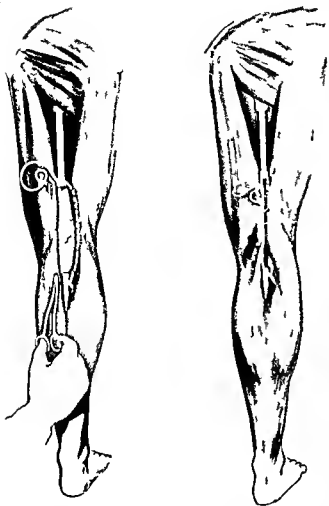


Fig. 4 Showing, ap. at lly r cetin f egme t f cat r c and its branche de toy dly scar t ue elem off m tion f central flap an plan f voidin ca t u by tunn line conti uou muscle fr eque tation f ner fl j hemic of utar by (a) na tomosi f xternal poplit lant the internal j lteraln e and (b) central flap t thir o resj n lin f phleat ner enl (Ca )

tively small area of thermic analgesia (7) The direct sensibility of the new track of the nerve to deep pressure and the transmission of painful sensibility thereby to the foot (8) Loss of muscular sense (9) Independent and unaided locomotion the man can not only walk long distances but can run at considerable speed

The citation of the first case leads one to consider another in which a complete reversal of the methods was resorted to viz the utilization of central instead of peripheral flaps Obviously no other method of treatment could be considered than the use of nerve flaps whether auto homo or hetero

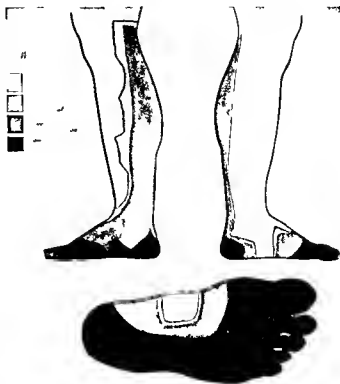


Fig. 11 Zones of tubular sensitivity in the calf

transplants The second case refers to one which because of a gunshot wound becoming infected resulted in the formation of so much scar tissue as to lead to the destruction of a considerable part of the sciatic nerve and its two branches So great was the destruction that a segment of four inches of the main trunk of the sciatic together with three inches of each branch had to be thrown in the discard Although the results were not nearly so successful as in the first case because of qualifying conditions of unusual character antecedent to my operation over which I had no control its silent features support the principles which the first case established

K. W. aged 32 a very rugged type sustained a gun shot wound of the left leg, in September 1913 with a thirty forty expanding bullet The bullet entered through the tendon of the biceps and came out through the popliteal space completely severing both the internal and external popliteal nerve There was complete sensory and motor paralysis of all the parts supplied by both nerves

An operation was performed for the relief of this condition by Dr. surgeon J. B. Bogardus of Montana Great care was exercised in the operation and the attempt was made to unite the divided ends of both nerves Unfortunately the elements of infection were in the wound and the operation

failed t j r p c Aft r crl month the  
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 t u e d n i l l e l l i n j o t i o n b y t v o t h r e e s l n d r  
 o d e d e t g i t s u t r e

I n d e r n o t o f u r l t h e d e l c t e n e e  
 f l a p s f o m t h e f a t e o f l e s t u c t b y s c a r t i u t h e

following maneuver was resorted to. A long slender curved probe pointed dressing forceps was passed through the muscular tissues as far as possible from the zone of scar tissue in the popliteal space the forceps was caused to traverse the inner head of the gastrocnemius and semi-membranosus and on the outside the outer head of the gastrocnemius and the biceps muscles. The end of the forceps was made to emerge at or about the level of the stump of the sciatic nerve. With the forceps the end of the outer filament was first seized and drawn through this muscular tunnel and sutured carefully to the truncated end of the internal popliteal nerve. By a similar maneuver the external filament from the sciatic was placed in its new muscular bed and its end in a cleft previously made on the outer aspect of the external popliteal nerve half an inch from the point of anastomosis. The wound was then closed and united throughout by first intention. The leg was placed in a position of mid flexion and was held there in a plaster cast. As soon as possible after the operation treatment by massage and electricity was instituted and continued for many months (Fig. 4).

Inspection made during the month of May of the present year two years after the last operation revealed the following conditions. There is a striking change in the appearance of the entire leg the color and texture of the skin look normal the muscles are well rounded and developed. There is no trophic disturbance. Four or five months following the operation there was a response on the part of some of the muscles of the leg to the toracic current with slight movement of two or three of the toes. This very limited movement passed away in two or three months. Locomotion over a distance of four or five miles without adventitious aid can be easily accomplished. There has been moderate recovery of epiepicritic and protopathic sensibility. Deep pressure is felt over the area of the distribution of both popliteal nerves and transmitted down the leg. There is excellent control of the foot and the leg on locomotion permitting only a very slight tendency to foot drop. There has been no recovery of motion in the muscles supplied by the internal and external popliteal nerves. Notwithstanding improvement in locomotion has been progressive. The foot is still vulnerable at points where the footwear presses unduly (Fig. 5).

Concerning this case it is only fair to say in estimating its values that it presented from the beginning grave and almost insuperable difficulties. Infection was virulent and prolonged and invaded intimately the sciatic nerve and its branches over long stretches. They were compressed by the surrounding tissues and adherent to them. Their sheaths had lost their luster and were thickened and doubtless the perineurial connective

tissue investing the axis cylinders was the seat of cell proliferation. The material that entered into the formation of the flaps therefore was of very doubtful quality.

Notwithstanding these drawbacks it is perfectly clear that extensive regenerative changes have taken place in the leg and that they are still progressive. Reasoning from analogy basing the reasoning upon the results obtained in the first case in which not only individual but large groups of muscles were restored to power and function by the use of very long and slender peripheral flaps it is held that under like favorable conditions namely early and timely operation and the use of sound central flaps a larger measure of regeneration and recovery of function would undoubtedly have taken place.

The third case illustrates the possibility of bringing about recovery of function in a divided nerve in the presence of infection in which there is a discharging sinus and bone necrosis.

O. I. entered my service in St. Vincent's Hospital June 18, 1915, suffering from an ununited fracture of the right humerus the result of a compound comminuted fracture sustained four months previously when she was thrown from her horse. In addition to the fracture there was complete division and paralysis of the musculospiral nerve.

An operation performed in Victoria B. C. to reduce the fracture and restore the divided nerve failed in its purpose. Infection of the arm was present. On entering my service a sinus was found at the junction of the upper with the middle third of the humerus leading to dead bone. There was also considerable infection with discharge. The musculospiral nerve was found to be completely paralyzed. Incision revealed a necrotic segment of the humerus an inch in length resting between the fractured end preventing union. The musculospiral nerve at both ends was found to lead into dense scar tissue. A fragment of bone was removed the ends of the humerus delivered and the end of each fragment resected. They were approximated and held by a steel plate.

It was then found that the gap in the nerve was too long to allow its approximation. Accordingly a flap one and a half inches in length was made from the central end and made to bridge the gap and sutured to the other end of the nerve which was previously cross sectioned until it showed the normal nerve fibers. The involved area was then surrounded by areolar tissue taken from the arm and inset by the underlying muscular fibers by an overlapping suture. A small cigarette drain

is insert 1 and held in position for 15 to 20 days. The  
 house and the room is kept at a temperature of 70° F.

It is reported that the patient is able to walk after 10 days. The patient is able to walk after 10 days. The patient is able to walk after 10 days.

The case illustrates two striking features of the recovery of the peripheral nerve after the use of the flap operation in a case of peripheral nerve lesion. First, that the operation can be performed successfully in the presence of infection. It is one of the important principles that the peripheral nerve when divided should be immediately repaired whether in the presence of infection or not. It illustrates that in compound comminuted fracture associated with infection caused by violent injury the final result in the reconstruction of a member that is badly shattered may be achieved by the reconstruction of the extremity.

This is the case for neuritis. In this study is concerned. It is an obvious fact that any other method of handling the case could have brought about an equivalent result. Many military surgeons report to this method and help in the case when future can readily be effected upon the operation to release nerve when it is held in adhesion or otherwise and upon repairing them by the use of different kind designed always to bring about a restoration and future end result. With this purpose in view joint or flexed bone shortened and nerve deviated and other methods used to bring about the approximation of the divided nerve end.

What is to be done in many cases of nerve trauma in warfare in which gaps are great that the means referred to will not suffice. Are they to be left to their fate and deny any offer of reconstruction or repair? Is there not a place in very large branches in nerves for the autotransplant the homo or heterograft? Is there a place for neuroplasty in such cases? Is the experience recorded in these line fituous and misleading?

The study of the case furnishes an

opportunity for reflection on many phases of regeneration as they affect such delicate structure as nerves. We are aware that sensation motion and other impulses are transmitted through nerve trunks along definite paths each fiber possesses a definite and limited function. There would seem to exist however other forces than these which pass through nerves which have not yet been explained and which play an important role in regeneration. Thus the first two cases demonstrate the transmission of a force which governs nutrition and quickly arrests the shock. The effect is almost immediate and very striking. They also demonstrate that muscular tone follows promptly upon the phenomenon of a divided nerve. The muscles with out having motion develop a certain firmness bulk and roundness and cease to undergo further atrophic change. Other influences might also be mentioned.

Nerve are generally in contact with muscle and muscle a naturally the protective environment of the nerve. The injured nerve when the process of repair begins recedes from contact with all tissues except the muscle. In muscle it finds a congenial soil for the reason perhaps that the first tendril given off by the regenerating nerve and in the mechanism of the muscle many fine little nerve filaments with which they can establish relation. In any event it seems certain that the muscle undergoes quick changes in firmness and substance if not in function as a result of the early repair of a divided nerve.

Objections are urged by writers to the mutilation of any nerve tissue for purposes of repairing damaged nerve. This would seem to be a mischievous way to lay down especially in the case of large gaps in nerve. It would deny the surgeon access to nerve trunk above or below the gap. What after all is the value of the vast trunk above a large gap? Is it not in great part like the branches below the gap without function and useless? What is more natural than the assumption that each tissue must furnish its own reparative material for its successful repair? Why should a different law apply to the nerve than to the tendon muscle or

blood vessel? Why not utilize the trunk and its branches in all cases as freely as possible to repair large gaps in nerves in order to attain the maximum degree of regeneration and recovery of function?

The note sounded in the treatment of these cases by recent writers condemning these methods does harm to the cause of nerve surgery and might seriously affect the future of crippled soldiers who urgently need nerve repair as a means of their reconstruction. It is here urged that caution be always used in all cases of the kind under consideration looking to the utilization of nerve tissue that is known to be sound that the utmost delicacy and tact be used in the handling of these delicate structures and that the region affected especially the neighboring muscles and joints be always placed in an ideal state for their recovery.

#### CONCLUSIONS

The study of this limited group of cases would seem to warrant certain deductions.

1 That regeneration and recovery of function is promoted by the use of nerve flaps

2 That both central and peripheral flaps can be used for such purposes

3 That a peripheral flap by laying down a nerve path may promote regeneration over a great gap in one case quoted regeneration occurred over a gap ten and three quarter inches in length

4 That the approximation of nerves and their repair should be done in all cases with the least possible delay (This would apply as well to cases which are infected as to clean cases)

5 That the arrest of trophic shock can be promoted by early closure of large gaps by flaps

6 That unimpaired nerve tissue should always be utilized for the effective repair of damaged nerves

7 That in their repair nerves can be successfully sequestered in muscular tissue so as to promote their own regeneration and that of the muscles in which they are embedded

8 That the principle of sequestration can be utilized in proper cases so as to avoid infected zones in wounds and also scars and other obstacles to nerve repair



SURGICAL CONSIDERATIONS OF PERIPHERAL NERVE INJURIES<sup>1</sup>

By BYRON STOOKEY, A. M., M. D.

C. pt. (R. I.) R. I. A. m. M. d. I. C. r. p. s. 5. 5. C. p. M. d. cal. Reserv. C. r. p. U. d. Stat. Army

THE more recent advances in our knowledge of nerve injuries has greatly modified the indications for surgical interference and the technique of peripheral nerve surgery. In a previous article (1) the various types of nerve injuries and their manifestations were dealt with in detail and do not enter into the scope of this paper. It is imperative that we determine in so far as is possible when to operate and what type of operation should be done.

Immediate suture in war wounds is rarely possible because nearly all are infected. In war surgery many additional problems arise due both to infection and the extensive destruction of tissues. The loss of nerve substance is frequently considerable and the amount of scar tissue present excessive.

It is a fundamental principle of nerve surgery that all operations must be done in a sterile field and in the absence of the possibility of infection. Hence secondary suture is the rule. Peradescence of infection in an apparently healed wound must always be considered. More especially is this true when there has been extreme comminution of a fracture or when there remain in the field cattered fragments of metal. The presence of these in an X-ray picture should mean a longer delay than might otherwise have been deemed expedient. Many times at operation these fragments are found walled off and surrounded by mucopurulent fluid. When such loci are broken into infection may light up and the aim of the operation be annulled by increasing scar formation both by another infection and by the added insult of an additional operation. Therefore sufficient time must elapse to insure a clean non-infected field.

The aim of surgical interference is to facilitate the normal process of repair by removing all causes hindering the downgrowth of the neuraxons and to facilitate their growth either through normal paths i. e. by end to

end suture or down newly furnished paths be they nerve transplants or artificial conducting paths.

Since secondary operations only are permissible at what period should they be undertaken? The first consideration is as we have said a sterile field. The second consideration is the nature of the trauma and the progress of the nerve injury. Not all nerve wounds require operative intervention. A larger percentage variously estimated between 40 and 60 per cent recover without operation. Gerulanos (2) reporting cases from the Balkan war claimed 40 per cent recovered. Tinel (3) in the war placed the percentage nearer 60. However it is but just to state that in a considerable proportion of the cases the time of convalescence might have been materially shortened by a comparatively slight operation.

Unfortunately with the exception of partial and incomplete nerve injuries it is impossible to determine except by waiting a sufficient length of time to allow for evidences of nerve degeneration to manifest themselves whether a nerve will recover without operation. Therefore it is of the greatest importance to study at definite intervals all available data and to be governed by the changing picture thus collected. The progressive changes are more important than the clinical picture at any one particular time. For this reason it is essential to have a report of the successive findings in any given case. The ignored importance of early and frequent examination cannot be overemphasized for it is only by such measures that one can become cognizant of the changing pathology of the lesion. Only by careful consecutive examination can proper and adequate treatment be outlined and needless delay prevented.

It is an axiom of peripheral nerve surgery that so long as there are progressive signs of nerve regeneration no surgical interference

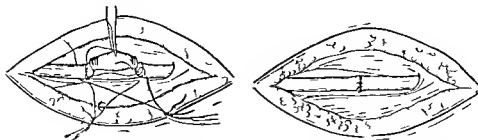


Fig. 1 and 2. Nerve with scar to be excised. Illustrates method of using scar as means of location of nerve ends permitting greater accuracy and facility in suturing. Needle should enter slightly obliquely tends to prevent suture from tearing out. Stay suture also helps to prevent axial rotation and can be withdrawn when other suture is in place and tied. Note consecutive partial incisions through scar until apparently normal nerve funiculi are reached.

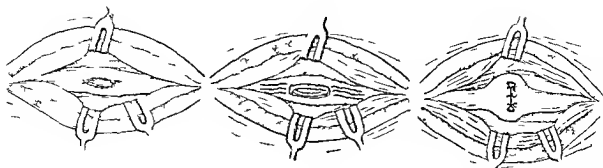
is permissible. What then are the evidences of nerve regeneration? The earliest and most reliable are formation, shrinkage of areas of anesthesia, return of deep sensibility, return of muscle tone and muscle sensibility.

Of these perhaps the most important and interesting is formation. This sign is elicited by gentle pressure upon the nerve trunk producing thereby a peculiar creeping sensation referred to the peripheral distribution of the nerve. The progressive regions along the nerve at which this phenomenon can be elicited is an excellent guide of the progressive downgrowth of the neurites. Shrinkage of the areas of anesthesia is a reliable early index of regeneration. The concentric contraction from above downward of the borders of loss to pin prick and temperature sense especially extreme degrees of temperature are early signs of nerve repair. Frequently there occurs dissociation of temperature sense extreme degrees of both hot and cold being confused hot being appreciated as such one time and recognized as cold the next instant and vice versa. Deep sensibility often returns earlier than other forms of sensation. The return of muscle tone and muscle sensibility occur at about the same time. There are other signs of nerve regeneration which manifest themselves further in the progress of recovery. The above signs of regenerating nerves give a very good index of the progress of their repair. As long as there are signs of progressive regeneration operative intervention should not be undertaken. When these have ceased to advance or when after due and repeated examinations they have not

appeared surgical interference is definitely indicated. In from three to four months some evidences of nerve regeneration should manifest themselves. By waiting this long little time is lost since during the greater part of the intervening period the wound has been infected.

The time of operation will then depend on the progress of the case and the probability of a sterile field.

Considered from a surgical standpoint alone the earlier the operation is undertaken the less difficult it is the clearer the anatomical field the better the operative end result and the more complete the recovery. The longer the delay the greater the amount and density of the scar tissue and callus the more bound and fixed in a retracted position becomes the nerve trunk and the denser the connective tissue within the nerve. Further more the longer the delay the greater the secondary changes in the muscles and tendons etc. Hence from a purely surgical standpoint there is every justification for early interference. The well established fact that a certain percentage of nerve lesions recover without operation offers the only valid objection to early surgical interference. However which cases will recover and which cases will not recover can be determined only by waiting evidences of regeneration. Rather than remain inactive too long an exploratory incision should be made in certain cases. Unfortunately before operation even by the most careful examination it is impossible to distinguish those nerve lesions with anatomical loss of nerve substance from those with



For the purpose of the following discussion, the method of the grafting of the nerve ends is of the greatest importance. The following are the methods of the grafting of the nerve ends.

interruption of conductivity without loss of anatomical continuity. When complete both manifest themselves alike. By early exploratory operation those cases would be recognized which could not offer any possible hope of recovery without surgical interference. Therefore in selected cases careful exploration is indicated.

No surgical procedure should be undertaken without electrical study, both before and during operation. Nerve operations are operations of choice and should be done where there is both ample facilities and ample time for thorough study.

A general anæsthetic should always be used. When the patient is anesthetized and before the incision is made the extremity involved should be freely mobilized and adhesions broken up so that the part may be placed and held in proper position after operative treatment. If there are contractures these should be corrected in so far as is possible before operation. Correct preoperative and postoperative treatment unless properly carried out would very likely annul the success of the operation.

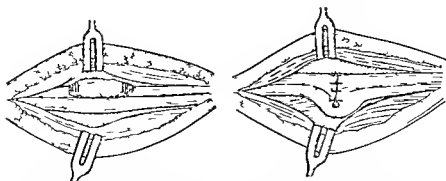
An absolutely dry field is one of the most important conditions of surgical technique. The use of the tourniquet is to be avoided because each bleeding point should be dealt with individually. Kocher's blood platelet preparation if available is very helpful in checking capillary oozing within the scar tissue. A weak solution of adrenalin also gives excellent results. Hemorrhage from the nerve ends is often profuse and is best controlled by gentle and prolonged digital

pressure. Bits of torn muscle held over the nerve ends will be found advantageous in checking hemorrhage. Blood between the nerve ends increases materially the amount of connective tissue formation.

In wounds with the nerve imbedded in much scar and callus it will be found safer to dissect from above down and from below up from sound and normal tissue into scar. Much time will be wasted and damage done by searching in the scar for the divided nerve ends. The distal end usually is small frayed and diffused in the surrounding scar. Care must be taken in freeing the nerve not to cut nerve branches to adjacent muscles. For these reasons it is apparent that operations on peripheral nerves offer many difficulties and require both skill and patience.

When the nerve is freed from the immediate scar it can be freed and liberated in its contiguous parts by gentle traction. This is best done before excising the intervening scar. This admits of using the scar to make traction thus avoiding additional trauma to the nerve trunk or nerve ends. Squeezing the nerve end to make traction must be avoided.

It is good procedure to cut only partially through the scar using it as a means of fixation for the nerve ends. Two things are thus gained: first it is easier to suture when the ends are fixed; second by so suturing there is less tendency to axial rotation and consequently greater accuracy in maintaining the internal topography of the nerve. The more accurate the union the more complete and the earlier the return of function. How



Figs 6 and 7 Partial injury to sciatic peroneal portion involved Nerve ends first mobilized Series of multiple incisions with line of excision sharply made Sutured with plain catgut without tension

ever it is many times impossible to attain union of divided ends with due regard for the internal anatomy of the nerve. Accurate juxtaposition should be nevertheless the aim toward which the operator should strive.

Small smooth round half curved needles with either fine silk or plain catgut should be used. For smaller nerves such as transplants the finest silk is to be preferred. The suture should include as little of the nerve as possible. The nerve ends should be brought gently into alignment without pressure or tension. Care should be taken not to handle the nerve ends with forceps. A small amount of connective tissue will always form between the nerve ends. The thinner the layers of connective tissue the less resistance will the neuraxons meet and the more complete the regeneration. A method which is especially to be commended is as follows. Three sutures are equidistantly placed each including a little more than the epineurium (this is better than to take too little tissue for then the stitches are very apt to tear out and still greater damage be done in an effort to re-suture). The suture ends are clamped and not tied until all three are in place. Each one acts as a guy suture in the placing of the next suture. If necessary a primary stay suture may be used until the other three are in place and tied. This stay suture may also be of assistance in preventing axial rotation.

The type of operation depends on the anatomical findings considered together with the clinical picture and the results of successive examinations. It is often impossible even at

operation to determine whether or not nerve axes have reached the distal stump. If the axes are new and have not as yet reformed the motor end plates then even though they have reached the distal stump there would be no electrical response. A negative electrical response at operation is thus of little value. Longitudinal incision and partial consecutive incisions as well as palpation may give additional information concerning the relative proportion of funiculi and scar tissue. Correct judgment can only be gained by wide experience and by checking observations by microscopical examination of the tissue excised.

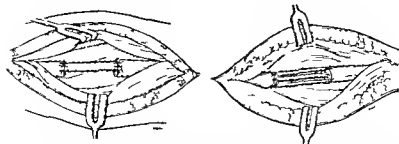
There are three main types of operations: neurolysis or nerve liberation, suture, partial or complete nerve grafting.

Nerve liberation consists in freeing the nerve trunk from all surrounding scar and callus. In many instances the nerve may be found completely included in scar tissue and the nerve trunk itself evaded. Nerve liberation is successful only when the nerve trunk has been completely freed and when there is no scar within the nerve. In the presence of interstitial changes excision and nerve suture must be undertaken. In the instances in which there is slight interstitial scar tissue conservative measures may be attempted. In such cases by injecting salt solution under pressure into the nerve adhesions may be broken up and new channels opened for the neuraxons since we know that neuraxons may grow through loosened scar tissue.<sup>1</sup>

D El be g m k es f ry m ll i g t d l i  
th gh th p m d th pe w b l f th cu es  
Ta m hod has m h t mm d t th gh l h b d personal  
pe in t use







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 t h m l c t s f t h a r m l g A g l t h u g h d t h r g h  
 f l k t d t h g h t h e g f t h e e l o t h c t s u r f a f  
 t h i u t t t h p u m T h e g f t s g t l y a p p r a i m t e d  
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Another complication occasionally found is injuries to the apex of the lung. At the time of injury these are overlooked due to the extreme paralysis as a result of the lesion of the plexus. In cleaning out the scar tissue and in freeing the nerve trunks at the operation for nerve repair the pleural cavity may be again opened. Such a complication should always be thought of in injuries to the lower cervical trunks.

In cases in which there is exquisite and intractable pain surgical intervention may be indicated in spite of evidence of progressive nerve regeneration. The exact pathology of causalgia is not fully understood. However some are produced by pressure on the nerve from without and by scar formation within the nerve. In the former group relief may be immediate after freeing the nerve from the scar callus or from around bony exostoses. When the cause lies within the nerve Sicard (9) has recommended the injection of 60 per cent alcohol. With this method I have had no experience.

In view of the comparatively large number of peripheral nerve injuries the seriousness of their disability the protracted time that

they are under treatment and the relatively hopeful outlook when properly handled it is imperative that they be given the benefit of the more recent advances and the soundest principles of treatment.

In conclusion it is a particular pleasure to express to Dr. Huber my deep appreciation for many valuable suggestions and much practical assistance.

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IMPROVEMENTS IN RECONSTRUCTIVE SURGERY OF THE HEAD<sup>1</sup>

By JOHN B. ROBERTS, M.D., F.A.C.S., PHILADELPHIA  
 P l a s t i c s u r g e o n t o t h e C r a n i o l o g i c a l S h o o l o f M e d i c i n e

THE frequent deformities due to gunshot injuries and burns in civil and military life and those developed in the scars of operative mutilations claim surgical attention. Variation of details in the plastic repair of lesions of different regions of the body from the ones mentioned. Nevertheless the principles of the surgeon's reconstructive work and the steps through which the organism responds to his desires are essentially the same in head, trunk, and limbs. An ignorance which often causes surprise still exists in the mind of some as to the usefulness of treatment for cicatricial deformity of the face. This lack of knowledge of recent progress in operative surgery appears not only in rural populations but is constantly exhibited by dwellers in large cities.

Congenital malformations like harelip, cleft palate, webbed digits, and cicatricial distortions from slow healing of burns and crushing injuries appear at metropolitan hospitals for treatment months, even years after the precious early moment for corrective surgery has passed.

Appreciation of the value of prompt plastic aid is gradually being instilled into the minds of surgeons by the lessons of the present European War. The energy exhibited by the contracting force of fibrous tissue when it replaces granulation tissue in wounds is astonishing. Carrel and deLamaze have shown that when open wounds are compelled by infection to heal through the conversion of granulation tissue into scar tissue, the major part of the closure is effected by dragging the boundaries of the ulcer toward a central point. Thus it is that the epidermization is reduced to a minimum and the cutaneous defense against ingress of microorganisms re-established. The effect of this interstitial contraction however on the surrounding and underlying structures is lamentably evident. Slow healing of wounds or ulceration after operation or separation of dead tissues may

cause eversion of lips and eyelids, closure of orifices, strictures of ducts, adhesions that restrain the movements of joints, and may even lead to dislocation of the fingers and toes.

Reconstructive surgery is simply a part of general surgery which has been developed by a study of nature's methods of repairing wounds and the adoption by the surgeon of such mechanical aids as will further the re-creation of normal contours and re-establish prior functions. Its object in the main it may be said is the construction of absent or lost parts, and the reposition or curtailment of parts displaced or deformed by injury or disease.

The deformities which it is designed to correct may be grouped as those due to—

1. Imperfect fetal development such as webbed fingers, cleft palate, supernumerary digits.

2. Ablations of tissue as in war wounds and operations for injury or malignant disease.

3. Ulceration or necrosis as in urinary and salivary fistula, occlusion of orifices, stricture of canals, loss of portions of the skeleton.

4. Contraction of scar tissue causing adhesions about joints, eversion of lips and borders of orifices, fibrous ankylosis of articulations.

5. Overgrowth or irregular contour as in gigantism of nose and ears, flaring ears and adipose overgrowth in abdominal wall.

6. Conversions of rigid structures into movable ones as in bony ankylosis of joints, and flaccid structures into rigid ones as in operations for non-union of fractures.

Recent developments have taught that nearly all tissues can be repaired by plastic procedures if the operative technique is mechanically efficient, provided that the wounds be kept aseptic from the moment of their production to the end of the period demanded by nature for the metabolic re-establishment of function. The functional



repair may be inferior to the original status of the parts but re-education of the patient's mind, nervous system and circulation accomplish in time wonderful increase of efficiency. The change of a slender graft of bone placed between the epiphyseal end of the tibia after necrosis into a thick weight-bearing column seems nearly miraculous. The return of energy and motor function to fingers after nerve grafting in the arm almost resembles the raising of the dead.

Under some circumstances a failure to maintain in a quiet condition of reconstruction wounds does not imperil the ultimate results very much. It does however prolong the time of recovery. This statement is applicable especially to osteoplastic operation.

The patient to undergo operation should be in good health and the tissues with and upon which plastic operations are to be done should be free from local deterioration. The operative field and technique must be aseptic and the after-treatment should maintain a similar freedom from infective agent. The great adversary in plastic surgery is bacterial infection; the other enemies of success are tension on sutures and too early disturbances of the repaired tissues. Meddlesome inspection by unskilled assistants is a great danger. The surgeon usually will do well to permit no early mobility and prohibit any one but himself or a trained coadjutor looking after the dressing of his operation wound. The prolonged fixation is of pre-eminent importance in bone grafting of fractures except perhaps in mandibular reconstruction.

The method of plastic surgery are

A Displacement (a) approximation (b) in harelip (b) sliding to transfer tension (c) in ectropion

B Interpolation borrowing material from vicinity from another region or from another person or animal (1) transferring flap with pedicle—(a) at once (b) by successive migrations (2) transportation with pedicle—(a) direct from hand or arm (b) indirect by using hand as carrying agent (3) transplanting without a pedicle (grafting)

C Entthesis burying in the tissues foreign bodies such as paraffin wire metal glass rubber

D Petrenchment cutting out ellipses or wedge as in gigantism of ears and nose

I Substitution rectum for bladder bowel for vaginal appendix for urethra

I Strategic temporary displacement as mandible to get at pharynx zygoma and cranium to reach brain

The operative step in simple procedures are—

1 Freshening edges and cutting away fibrous scar tissue if new tissue is to receive blood vessel connection therewith

2 Obtaining flaps if necessary

3 Arresting bleeding

4 Adjusting parts in proper relation with out tension with sutures tacks staples Michel clip

5 Closing gap left by cutting out flaps

6 Dressing wounds aseptically and keeping them aseptic

7 Preventing too early motion and undue handling of tissues reconstructed

In complicated procedures a series of operations extending over months may be necessary each operation forming a basis for the succeeding one. Too much should not be attempted at once. Sufficient time should be allowed for healing and contraction.

#### METHODS OF PLASTIC SURGERY

*Manner of making cutaneous flaps with pedicles.* Pediculated flaps should be large, thick and with a good vascular supply through a wide pedicle. Artery and vein may be in the flap or partly denuded of skin. The subcutaneous fascia must be included. Because the skin when cut loose contracts the flap should be 30 to 40 per cent larger than in the opening to be covered.

The edge of the gap to be covered should be freshened by cutting away the fibrous cicatrix before making the flap.

This flap should be made so that the cardiac end with artery runs into its base.

The long axis of the flap should correspond with the direction of arterial supply. This rule may be neglected if the anastomosis is free.

It may be well sometime to cut the flap and wait a few days before stitching it in place. Care should be taken not to twist the pedicle so much as to close the artery or vein.

The arterial supply or venous discharge should not be impeded by tension.

If either event is evident on the second day the stitches should be taken out to restore the arterial current or the flap should be punctured with deep incisions to lessen venous engorgement. Injurious tension may be relieved by making a pedicle with curved or angular borders.

Hæmorrhage should be stopped before applying the pediculated flaps and the flaps should be placed loosely, not in a stretched condition.

#### *Manner of making transplants (or grafts)*

The tissues must be aseptic, not antiseptic. The grafts must be aseptic and not injured by mechanical or chemical irritants. The surfaces to be grafted and surfaces from which grafts are to be obtained should be sterilized if not already sterile. If antiseptics have been used the surfaces should be bathed with sterile normal salt solution. The grafts should be kept wrapped in dry gauze at operation. Carrel uses grafts kept in cold storage for long periods. Pieces of skin, nerve, fascia, fat, tendon, cartilage or bone may be used as grafts. Skin grafts of whole thickness should have the adipose tissue clipped off. The graft should be placed in contact with like tissue where a gap exists. The graft should be held in place by pressure or sutures. In skin grafting the air should be pressed out from under the graft.

*Dressings.* Mild antiseptic solution may be painted along the wound if pediculated flaps are used. No antiseptics may be used with transplants (grafts). Dry gauze dressing should be used, aseptic of course. Warmth by dry heat outside the dressing when blood supply is doubted may be necessary. The wound should be kept quiet and the dressings should not be disturbed early or often. The wound should not be uncovered earlier than the fourth or sixth day if free from contamination with saliva or mucus from the mouth, nose or eye.

Facet wounds will often do very well with out any gauze dressing. I usually prefer none or but a single layer of dry gauze.

*Results.* Pediculated flaps or grafts that remain healthy for four days are not apt to



FIG. 1. (At left) Excision of mandible. Flap on cheek removed with Masland electric saw. Rigid metal wire inserted in mandibular canal to hold fragments apart. Photograph taken several weeks after operation.

FIG. 2. Uranoplasty for congenital double cleft of soft palate. Horseshoe flaps displaced backward and anterior edge held against bony palate by intraoral suture. Faucial pillar were temporarily stitched to ether

slough. If within this period the flap or graft becomes grayish pulpy and shows loosened cuticle, venous gangrene is probable. If however it becomes whitish then dark and withered arterial gangrene is probable. If gangrene seems imminent it is possible that only an upper layer or the edges will die. Hence do not cut away slough too hastily. In arterial gangrene take out the sutures that seem to cause tension even if you separate the whole flap except the pedicle. In venous sloughing scirrhify and puncture the tissues of flap and also relieve tension of pedicle by cutting a few sutures or untwisting pedicle.

The innumerable head injuries of the present war and the energy of military surgeons who have been brought into contact with these traumatism have given a great impetus to the study of reparative surgery of the head. In the civilian school of plastic and oral surgery established by the Surgeon General of the Army at Philadelphia marked interest was at once evident in the laboratory practice of this branch of reconstructive surgery. Old methods were made familiar to the younger men, new ideas and procedures penetrated the indurated brains of those who were older. As must always be so, the seniors have been

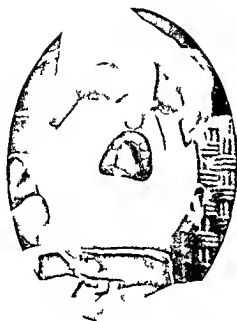


Fig. 1. Mandible detached from the skull.

greatly improved by the progress in plastic surgery developed by men like us than ourselves. To all attention must be paid to the new ideas in plastic surgery of the head and to set down some of the principles which war surgery has crystallized in the mind of men. This is the chief object of this paper.

Surgeons have been taught to realize that important element in the treatment of war injuries are prompt resuscitation, fixation and immobilization. In gunshot fracture of the mandible for example prompt immobilization followed by reduction and a relatively normal dental occlusion have been accepted by general and dental surgeons as a factor of great moment. In time may increase in fractures with loss of bone which justify coaptation and fixation of the end of the remaining fragment with forest for a while of the proper occlusion of the remaining teeth. These injuries are not so common as those in which temporary interdental splinting to fix the fracture and maintain an approximately normal bite will be more advantageous.

A large proportion of mandibular fractures in war are not only comminuted but also contaminated and probably already infected

when seen by the surgeon. Prompt fixation of broken bones in the limbs has long been an axiom of general surgery. This rule applies even more rigidly to comminuted and open fractures sure to become infected in the oral region. Hence fixation before transportation applies to gunshot fracture of the lower jaw bone. While it is true that the constant flow of saliva and the ease of establishing an abundant drainage by incision usually will lessen the violence of septic complications in mouth injuries it is almost obligatory that imbedded foreign bodies in the floor of the mouth and in the neck be immediately removed to avert infection. The term foreign bodies include bullet hit shrapnel piece of clothing or ball chain gravel displaced teeth and small unattached splinter of bone. Large pieces of bone covered with perosteum should not be disturbed but replaced as accurately as possible.

Early reconstruction of the skeletal foundation of the face is an important factor also in maxillary and nasal fracture. For this purpose general anesthesia may sometime be demanded. It is desirable with nitrous oxide gas for the primary anesthetic effect of ether. Conductivity in the maxillary maxillary canine may be sufficient. Early excision of contaminated fracture followed by immediate and late suturing of wound edges will often be followed by early healing. As the bone of the face in uninfected fracture unite quickly prompt restoration of bony contour should be the aim of treatment. The same rule by the way applies also to replacement of torn and displaced integument and other soft parts. Facial deformity from trauma is often a discredit to the original surgeon attending. Much satisfaction will come to the family physician who though not a surgical specialist has grit enough to administer the first aid to a lacerated face in much the same way that his wife would act upon his torn coat. To put the torn edges at once in place and keep them there with stitches would be her motto. He should do the same with a torn face but would better not use continuous suture and should leave space for ooze of blood and drainage between some of the stitches. She would perhaps

wash her hands before starting the job. He should clean both his hands and the patient's face ere he sews up a wound.

When there is a considerable loss of bone in a gunshot fracture or after excision of the lower jaw for malignant disease the ends of the fragments remaining should be held apart with a spreading dental apparatus to prevent dragging of the ends together by muscular action. The resulting contraction if not thus averted will become confirmed by muscular and cicatricial changes and a V-shape jaw or other deformity produced which may be curable never or only after months of painful treatment. If the ends are held apart by a temporary interosseous mass of modeling compound a wire brace in the bone, an interdental splint or other fixation apparatus for a few weeks the fragments will remain apart. Then a permanent prosthetic appliance may be adapted or an osteoplastic operation performed to complete the body of the mandible and restore facial contour (Fig. 1).

Large flaps of skin and muscle may be swept from their bony attachments in machinery accidents and in military rivalry. The primary appearance of a patient whose face is so ripped apart is appalling. The bloody masses of integument, muscle and mucous membrane may be smeared with tears, saliva and dirt and contain fragments of bone, detached teeth, food and vomitus. Speech may be almost impossible from laceration or swelling of the oral structures and asphyxia impending. Thorough cleansing (sometimes with excision of damaged tissue) and an immediate replacement of the huge flaps torn from scalp, forehead, cheeks or chin will restore the patient's visage to a fair resemblance of a human face. It will also add vastly to the chance of moderate septic symptoms and lessen deformity from scar distortion.

The availability of ordinary carpet tacks and small staples for keeping the replaced tissues in contact with the underlying bones will be recognized by surgeons with a mechanical turn of mind. Dental surgeons have shown that spring trusses somewhat like inguinal hernia trusses may be used for this purpose where sutures seem unserviceable. Use is

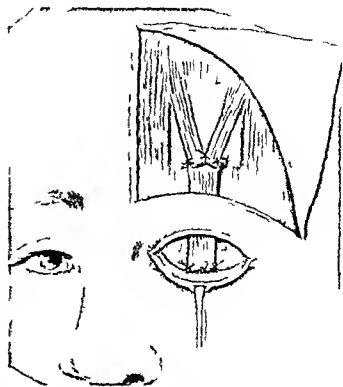


Fig. 4. Diagram of Robert's muscle suturing operation for ptosis of upper eyelid.

made of the floor of the nose or an intermaxillary splint is inserted to give a supporting base for the spring. Extensive flaps may thus be kept in normal relation to the uninjured structures. Wire or silkworm gut sutures inserted into the loosened integument may be carried by means of long straight needles through the deep structures into the mouth, where they may be fastened to the teeth of the upper jaw. A piece of wire twisted around the neck of a canine tooth or fastened to a hook soldered to a metal band clamped on any available tooth will give the oral end of the suture the desired hold. Any convenient tooth may be used as the anchor.

I have ticked with much satisfaction a plastic flap from back to cranium in accidental scalping of a child. In plastic operations on cleft palate a valuable expedient in some forms of urino-plasty is to hold the bilateral mucoperiosteal flap against the denuded bones with a long mattress suture, the two ends of which are carried up through the palate cleft into the nose and out the anterior nares. Here the ends are tied together outside of the columella. One end may be made with





Fig. 7 (at left) Making osteoplastic cranial flap, the drape with Masland's (Model 1918) and Robert's trephine made in '38 for trephining with Bonfield talence. Figure at right shows the flap being inserted into mandible after emptying Masland's.

Fig. 8 Osteoplastic flap made everted.

plastic operations. In this country Davis has contributed valuable ideas among others the use of rubber netting to hold skin grafts in place against the unhealed tissues beneath. Isser of the Austrian army recommends what he calls epidermic ink with dental modeling composition. This device keeps Thiersch grafts in accurate contact with the underlying surface by means of pressure from a negative of the surface made of sterile dental compound. The method is available for skin grafting the raw surface of a skin flap to be used for repairing the mouth or cheek to deepen the conjunctival sac for wearing a glass eye or to obtain an epidermic surface on both sides of a flap for any operation. In the last case the surgeon freely undercuts the intended flap makes a cast with heat softened modeling composition which soon hardens of the cavity under the skin covers the entire surface of the cast with thin skin shavings with their epidermis against the cast pushes into the hole the cast covered with grafts and sews up the wound. Two weeks later he removes the buried cast from the cavity by an incision. These maneuvers furnish one or more flaps with normal skin on one side and Thiersch graft skin on the other. The cast is used for the next step of the intended operation.

One of the most satisfactory outcomes of the present interest in osteoplastic surgery

so far as my own work is concerned has been the great improvement made by H. C. Masland of Philadelphia in his osteoplastic saw. I have used it in operating room and the surgical teaching laboratory. He has now devised an instrument superior to any electric saw with which I am acquainted. It is convenient in size and may be readily sterilized. It makes with accuracy and rapidity the osteoplastic trap doors needed in brain surgery, the bone grafts from the tibia used in fractures and in tuberculosis of the vertebrae and gives the surgeon an ever ready instrument for excision of mandible or rib. It is run by a motor and flexible cable and is guided with one hand of the surgeon with almost the convenience and delicacy of a pocket knife. In craniectomy two small openings are made with an electric trephine or flat burr devised by me long years ago or with any form of perforator to gain an entrance for the drill operator. The saw then cuts vertical or oblique incisions in the bone at the surgeon's will and enables him to operate with one hand expeditiously and safely without danger to the patient himself or the fingers of his assistants.

The usual accessory instruments run similarly with an electric motor and cable provide a rapid means of drilling bone for wiring fractures making dowels trimming pegs and cutting slots for inlay graft. The accompanying



osteoplastic trap door for exposing the middle meningeal artery. It proved pretty conclusively that it would be as safe, rapid, efficient and satisfactory for performing the cranium as is a sharp scalpel for opening the abdomen. It seems to me to make the flat or fissure burr unnecessary, though that could be readily used instead of the trephine.

The advantages of the electrically driven burr or trephine over some of the more recent instruments for penetrating the skull are its simplicity and inexpensiveness. It needs merely to be attached to the mandril of any surgical engine run by hand foot or electric power used for drilling bone. The Gigli wire saw, the Masland saw or any other means of making bone flaps or grafts which requires a preliminary hole of entrance are available after the trephine opening is made with my burr or trephine. It is probable that

many surgeons now use electrically driven trephines. I mention my early experiments because such attempts have historical interest. When I devised an aseptic hand trephine which was used a good deal some years ago and had constructed the segment trephine for making large openings in the cranium, the initial steps were being taken by Keen, Briggs, Bergmann, Cushing and others which have borne such wonderful fruit in the domain of cerebral surgery.

When President William T. Briggs appointed me to open a discussion on brain surgery before this Association in 1885, I introduced in the title of my paper the word "imitation." Notwithstanding that qualification I was considered a foolhardy youngster who weighed not his words. Now my juniors are teaching us how few are the limitations in operative surgery of the human brain.

## THE APPLICATION OF THE TEACHINGS OF WAR SURGERY TO CIVIL HOSPITAL CONDITIONS<sup>1</sup>

By JOHN A. HARTWELL, M.D., F.A.C.S., New York.  
Director of Surgery, Bellevue Hospital, Medical Corps, U.S.A.

AND

ETHAN F. BUTLER, M.D., New York.  
Assistant Surgeon, Bellevue Hospital, Medical Corps, U.S.A.

THE war has emphasized many facts, a careful consideration of which should prove of value in connection with surgery in civil hospitals. One group of facts has to do with the general organization of our hospitals; another with the pathology, bacteriology and treatment of traumatic and infectious processes. We present certain aspects of both groups for consideration.

The war had been in progress but a few weeks when it was amply demonstrated that all previous training of surgeons had left them hopelessly deficient in the knowledge of wound processes. Conditions strikingly similar to those present in our Civil War were developing. To quote Moynihan:<sup>1</sup> "Suddenly the surgeon was confronted with a

large succession of cases in which a raging and often a rapid suppuration was present and he found that all the old remedies upon which he had so comfortably and confidently relied were hopelessly inadequate and futile. A challenge was so to say thrown to the profession and I think we may now with due modesty claim that it has been splendidly and triumphantly met. Rebukes and taunts at our incompetence were not seldom heard in those far off days. It is not unfair to say that these rebukes were to a certain extent deserved in that surgery had neglected one of its opportunities. The development of aseptic surgery following the teachings of Lister and Pasteur was so rapid the advance of the operative field into the abdomen

<sup>1</sup> The treatment of gunshot wounds. Surg. Gy. ec. & Obst. 97.



the cranium and the thorax held out such enticing promise the work entailed was so clean cut so attractive and so productive that the best minds were centered on it. The less congenial less striking and less comprehended field of badly traumatized and badly infected tissue was overlooked. There was no general grasp of the fact that such cases were *appallingly plentiful in civil life* and that they occurred to a great extent in patients in the prime of their productive life. Their care was relegated to a secondary place and the custom of considering them as the especial responsibility of the junior members of the visiting staff or even the house staff while not universal was more or less general. This resulted in a perfunctory routine treatment founded in most instances upon incomplete pathological and bacteriological knowledge. A tritition gradually developed that these cases at last must terminate in some degree of permanent disability and that no form of treatment would appreciably improve the result. In time the junior surgeon passed in what the majority of them found unconvivial work and entered more and more into the competitive field of major operative surgery. The surgeon thus untrained in this type of work reached the period of his greatest productivity but no longer had occasion to apply his developing power of sound judgment to the class of cases which constitute the vast majority of war casualties.

Under such conditions it is not surprising that the war found the surgeons unable to cope with it horror. The older men were confronted with a disease process to which they had given no consideration for many years. And the younger men suddenly found themselves overwhelmed with this thing which they either had put behind them or soon hoped to. We cannot help feeling that our lack of foresight merits a reproach.

Has there been any lack of opportunity during the past thirty years to have learned many of the lessons that the war has taught? Could we not have fathomed more of the secrets of wound infection and healing? Has a compound fracture been such a rare thing that more knowledge expressed in an au-

thoritative way has been an impossibility? Answers to these questions must indicate a failure to have profited by our opportunities. The defect has lain in that there has not been sufficient insistence on and striving after an improvement the need for which has been strongly or dimly felt by all the thinking members of the profession. The needed improvement is along the line of a definite reorganization of our entire hospital plan. The war has now demonstrated so that all may comprehend how this should be accomplished. If as Moynihan says the surgeons have triumphantly met the challenge thrown to them there has been one all important factor in their ability to do so.

The military situation makes it possible for the surgeon to call to his aid physicists chemists pathologists and bacteriologists. He is not dependent upon a casual contact with the trained minds of those men who have formerly been so content to expend their intellectual force upon abstract scientific problems the benefit of which he as the clinician was expected to apply to disease processes without help. Actually to see to feel and to know the bedside problems was to them a matter of little importance a field scrub in fruit and in the opinion of some beneath the dignity of a highly trained scientific mind. If the clinician did not find the time to make his home in the laboratory as well as in the ward and operating room he was considered of inferior caste yet the laboratory workers showed no inclination to come to the surgeon. How earnestly and futilely have we invited urged and cajoled the well trained men of our laboratories to come to our wards and operating rooms and give us the aid their training entitled us to expect from them and by first hand observation see the difficulties with which we were confronted. These confreres sent us a pathological interne who entirely satisfied them by bearing culture tubes and surgical specimens to the laboratory to receive routine treatment without regard to the great underlying clinical and pathological principles.

Surgeons have felt the hopelessness of such a situation and individuals have made successful efforts to obviate it by having a ward

pathologist and bacteriologist attached directly to the clinical staff. These however were young men with limited experience and could not bring to the study of the clinical problem a sound judgment founded on a long experience in a laboratory closely related to clinical study.

The war has demonstrated beyond further debate that corresponding progress will only be made in our civil hospitals if the patient is made the center of all its activities. The wards and operating room must have a staff of laboratory men just as they have a staff of surgeons. The art of surgery and the sciences on which it is founded cannot be compassed by the mind of one man. The laboratory scientist will be more productive by close contact with the surgeon and the surgeon will profit equally. Both of these staffs must be composed largely of full time men. Our military surgeons and laboratory men find no distracting calls outside the hospital. No one can conceive that the advance made in three years could have been possible if the best trained minds had spent three or four hours a day at the hospital and then left them to get on as best they might during the remaining twenty hours under the sole care of juniors and internes. It may be argued that to organize our hospitals on such lines will prove financially impossible. Such argument cannot be maintained. Money has always been forthcoming to foster any well thought out plan for the betterment of education and the best care of the sick and injured. Had the lessons in the treatment of the injured which this war is teaching been in force during the past two decades the money saved to our industries would more than have met the expense involved in having learned them. The duty of spreading this teaching lies with our profession and upon our success depends our ability to give to the country one of the offsetting benefits with which war to some extent balances its horrors. Another more easily accomplished phase of organization has also been placed in evidence in the military hospital. Every service has had at its disposal well trained mechanics and carpenters. Most surgeons in civil hospitals

TABLE I. COMPARISON BETWEEN THE ORGANIZATION AND PROFESSIONAL ACTIVITIES OF CIVIL AND MILITARY HOSPITALS

MILITARY HOSPITAL	CIVIL HOSPITAL
<p>O mm d g m d l f' w h o s g l t h t y u d m y p r e m</p> <p>All m u m b e r s f t h t f f o f l t m h a d g v t h d d d t t t t t w k w t h t h h p t l</p> <p>A b s l e t r r l t f l l d p m t t t t w t h t h e r t f t g t h p t t d t y t t h l t p b l m m t</p> <p>E h d p t m t d p d t m g t t b f t h d d t h p t t</p> <p>W t h e h d p r m t y l l t m g t p m t i l p l y s t l l d b y t h h f w t h t p p l o f t h m m d g</p> <p>M i l i t a r y m d l g t m o u s t g t t h m d f a l l y h i t t h c h t h g u l b l l u t l y t h t r m d t h</p> <p>I m g p t t d s m t w h y f f l m t g m m m d d t d p o s t f t h b t m e t t d t h p t t</p> <p>T h h f f t h r v f l l y q l t d s o c t l y m m d t t w h q f d</p> <p>L b o t e y m t l t d g d y m b m d e m d t b y m y w h l p t t g h t t t h d y t h d g m m f h d l g f a s</p> <p>V y l h r a t l d g f t h d y g h t d h t f f y t t d q t f t h h y k t h y m t p e f m</p> <p>T h l r e t d b y t f f t d m h d w h l t p p d w h p t t f r t h t m t f</p> <p>T h p a t m t b h l d h r t l c u d t t y b h a l l y m p e t h o p t l t l l w d h l f d t h p t t f l l y l t t l u s d t y</p>	<p>N b h f' w h t h t y p l y e f f t m r r p d</p> <p>I m t t b t f w f t h m m b f t h t f f t h t h h b f f r s f l t m b</p> <p>N l l t b t w t h l d p r m t d m t y l d a d l b t y h d p t m t b q m d p e d t f t h t h r s t d l p o b f p m m d g f f</p> <p>E h d p t m t d p d t d t n u t d m w t h t v n p b l m t h w t h m t l c o o p e t h s o l v g f m m p b l m</p> <p>T h d b t l y l m t h o s p t l d t t i n g r v t</p> <p>C l h o s p t l m y m y t p t p i t f t t m t d p d g t h t y p e f t h d y t h t t b q p t t m t</p> <p>I m g p t t w h b y h d h t m m t j d m t h r r t m t p o t t d t t t m t</p> <p>E p t d g h f d w t m e y y q l u f d m m b e t h t u n g t f f p t d q t t t m t</p> <p>T h m t t l f t p t t h a d h t w d d l o t h b l m d t h g h t m d d d t l h d g f p t t</p> <p>L h b t l d g x y l l b l l y d g p f d f f l d t h e k t b p e f m d</p> <p>R l y t d m e c h f o c f w t h t h f a l f t h p p t l p t t g</p> <p>T o o g t t d c y t t h b d l g f d g p r w e d t l l a s t y m d f l t t t p t t d p r m t t l e r t d s c h d p t t</p>

have vainly struggled to get a simple piece of apparatus constructed to meet some special requirement. There was no well

equipped shop at hand with a competent workman who could promptly furnish the apparatus and at the same time suggest ways of meeting mechanical problems for which his training fitted him. Trustees of hospitals have been very loath to recognize that other artisans than surgeons might be advantageously employed in a surgical service. The results abroad should be very effective in convincing them that this view is no longer tenable.

Table I contrast civil and military hospitals and suggests the lines along which reorganization should take place. Taking advantage of the opportunities above discussed which a well organized Army Medical Corps gave to them, the English and French used the enormous number of wounded coming under their care to master speedily some of the principles underlying the treatment of war injuries. The application of these lessons to our work in Bellevue Hospital where there exists a large traumatic and infected service constitutes the second point which we desire to discuss.

Four definite principles may be accepted as having been established. First, severe traumatic badly contaminated with bacteria need not go on to active infection and suppuration. Second, these sequelæ are largely the result of certain physical as well as biological factors. Third, if the sequelæ do supervene they may be largely controlled by removal of physical factors rather than by killing the bacteria. Fourth—a seeming paradox—aseptic surgery is not confined to clean operative wounds made through carefully prepared tissues. To test the applicability of these principles we utilized as signment by the Office of the Surgeon General to give a course of instruction in fractures and war surgery at the Cornell Medical College and Bellevue Hospital. All traumatic cases and all important infected cases were made a special service. The number at our disposal was on an average between thirty and forty. The range of cases was large and during the seven months the work has been in progress there has been sufficient of each type to permit of rather definite conclusion. We had associated with us the heads of the depart-

ments of chemistry, pathology, bacteriology, physiology and anatomy and being bound together by the common interest of teaching medical officers the work was from the start closely correlated thus to some extent giving us a semimilitary organization. For a point of departure we selected a study of the chlorine antiseptics.

Our first concern was to establish our practice exactly on the lines taught by Carrel, DePage, Dehelly, Dakin, Dunham, Dufresne, Lee, Furniss and others who have had the imagination to conceive and the patience to develop new procedures. Following closely the writings of these men and the practical experience of one of us (E. F. B.) at the Rockefeller War Hospital we had little difficulty in perfecting a smoothly running service in a few weeks.

Every detail of the Carrel-Dakin method with the sodium hypochlorite was observed and the method as described by Lee, Furniss, Sweet and others for the dichloramine T received equally close attention. We had no difficulty in practically eliminating pus from the wards and with a few notable exceptions the worst suppuration could be controlled in a short time. Immediately the question arose as to whether the results obtained were due to the more intensive care and study or to some inherent value in the various steps followed. Undoubtedly the former is an important factor but after seven months very close observation and analysis we have concluded beyond question that the treatment of most suppuration is definitely improved by the employment of the hypochlorite solution. We however are not prepared to accept the hypothesis that its greatest value is its bactericidal power. This property is a definite and in efficiency but in another more important attribute lies its greatest virtue.

Sodium hypochlorite in a watery solution of 0.45 per cent to 0.5 per cent—the limits prescribed by Dakin—is strongly proteolytic. It is more potent in digesting protein in dead form than in the form of living protoplasm though it can undoubtedly attack the latter. The splitting action is brought about by an interchange of the active chlorine

## STRENGTH

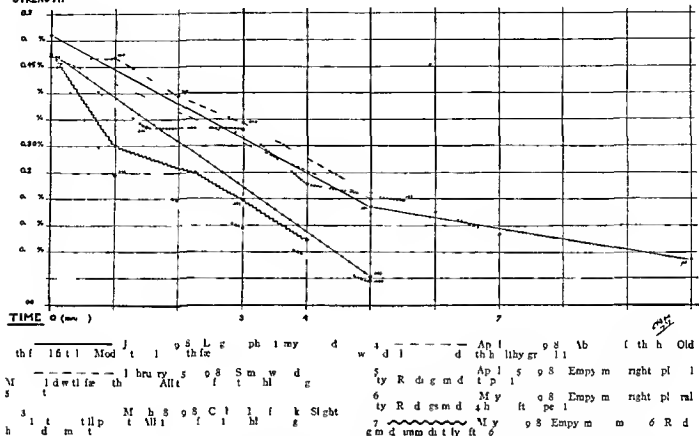


Chart Fall of strength of Dakin solution in wound

Curves 1 and 2 were made from the same wound on different dates. At the second reading the wound was much dirtier and there was more material within it. The high the Dakin solution could react and the fall of strength has accordingly been more rapid.

Curve 3 The fall in a comparatively clean wound. Curve 4 also represents the fall in a very clean wound in which the exudate is little. It will be noticed that the fall in strength during the first minute was negligible. Thereafter when the exudate was poured out from the lips of the wound the fall followed the rate noted in the other wounds.

in the hypochlorite solution and the hydrogen in the amino group of the protein. A chloramine first forms and then a dichloramine. The reaction probably does not stop here and a further substitution of chlorine takes place. The exact nature of this latter stage is not as yet established. The products however become more and more soluble and in this there exists a very definite advantage.

The reaction is in no sense specific. The protoplasm of bacteria is attacked with no more avidity than is that of the protein on which the bacteria live. The living human

tissue has however a strong defense against digestion. When the hypochlorite solution comes into contact with it an immediate response is the outpouring of tissue fluids containing an abundance of protein in solution. This dissolved protein at once takes up the available chlorine and in less than one minute the hypochlorite falls below the Dakin strength and in the conditions ordinarily obtaining in its therapeutic use a negligible amount of available chlorine is found at the end of ten to fifteen minutes.

The accompanying chart illustrates this as determined in various types of pathological

Curves 5 and 6 were made from the same wound. Curve 5 was made from a wound which had just been flushed with Dakin solution and therefore a considerable amount of the purulent exudate had already been washed out of this cavity. Curve 6 was made without any prior flushing of the empyema cavity.

Curve 7 was made as a second reading from the empyema cavity which had already been flushed once a day in this second reading the fall in strength was not so rapid as in the first reading when the cavity still contained a small amount of unchanged exudate.

lesions (Chart 1). If the wound under treatment contains an abundance of bacteria more or less destroyed leucocytes and inflammatory debris the first reaction is with these substances rather than with the tissue fluids freshly poured out. Thus the bacteria are killed the necrotic material is dissolved and the surface of the wound becomes clean. If on the other hand the test is made with an already perfectly clean granulating surface there is less immediately available protein and the hypochlorite strength is less rapidly though markedly lowered. It is interesting to note that for this reason skin irritation very rarely takes place around wounds of the former class even though no particular attention is paid to its prevention. On the other hand when a wound is nearly or quite clean and the less changed solution flows over the skin an irritation will take place unless the skin is protected. Knowledge of this fact is helpful in doing the dressings because only when the acute suppurative stage of the wound has been controlled does one need to watch all the detail of skin protection. Another observation in this connection is of interest. Unless the amount of Dakin solution is in great excess skin burns always remain very superficial. The explanation lies again in the fact which we desire to emphasize namely that Dakin solution in contact with any body fluids ceases almost immediately to be Dakin solution. The superficial burn pours out albuminous fluids hence the solution immediately loses its power to burn.

Early in our experience we encountered a case which at that time baffled our attempts to explain the sequence of events. With our present conception of the problem the explanation is forthcoming.

The patient was admitted with his arm torn crushed and fractured by a dog. A possible repair. He refused amputation so more than forty-eight hours by which time complete gangrene had developed. That ultimate should be joint done and the treatment with hypochlorite solution immediately instituted. The suppuration promptly controlled. It is probable pus could always be found deep in the wound at the glenoid fossa. This was never more than a few drops but it served to keep the bacterial count high and delayed the final healing of the wound.

One tube was regularly led to this point and the fossa was kept intermittently bathed in fresh solution. Investigation by opening the healing wound showed a necrosis of the glenoid cartilage. The poorly nourished tissue was not able to throw out sufficient fluid to neutralize the full strength hypochlorite poured upon it and hence was itself destroyed. Removal of the cartilage and bathing of the more vascular bone resulted in a prompt healing with complete closure of the wound. Had we fully comprehended this fact and protected the cartilage with the vaseline mixture as we protect the skin during process would have been much hastened and the cartilage would have lived.

This experience with our misconception of its nature led us to believe that Dakin solution should not be used in joint cavities nor in contact with tendons and other lowly vascularized tissues. Therefore when a patient presented himself with a badly infected knee joint showing a streptococcus we opened it by two lateral and two posterior incisions applied traction and washed the joint intermittently with ether or normal saline solution. His progress was distinctly bad. The suppuration burrowed the knee condition became more and more advanced and resection or even amputation seemed our only resource. Arguing that in any case the knee would have to be sacrificed and the hypochlorite would do no worse its use was instituted. Suppuration was controlled very promptly the joint cavity cleaned up extension lines down the leg and up the thigh showed healthy granulations and the final result is a knee joint far from useless. It was this unexpected result when compared with the necrosis of the glenoid which brought out the fact that cartilage and synovial membrane already the seat of severe inflammation by infection will not be damaged by hypochlorite. The hypochlorite attacks and is chemically satisfied by the products of this inflammation and the joint structures are aided by its action. The rule is thus formulated that recently injured joints in which suppuration has not taken place should not be exposed to hypochlorite. The response in tissue fluid may not be sufficient to protect joint structures from erosion. On the other hand a joint already infected and filled with purulent exudate may and should be so treated because the damaging tissue will be

digested away and the joint cavity returned to a more normal condition. Sound judgment must determine the degree of infection which should or should not be irrigated, the placing of the tubes within the joint, the amount of irrigation and the period at which it should be discontinued.

Our ideas as to the treatment of empyema have undergone an evolution similar to that for joint infections. Appreciating that the hypochlorite solution is very destructive to the peritoneum, pleura and endothelial membranes in general, we at first scrupulously avoided using it in the pleural cavity. The non-digesting chloramine solution 0.5 to 1 per cent was substituted in some cases. While this exerted a beneficial influence in changing the discharge from a purely purulent character to the less offensive mucinous type, it did not seem to hasten healing.

Reports came to us that other hospitals were boldly using hypochlorite solution even going so far as to fill the cavity after evacuating the pus through a rib resection and plugging the opening in order to get the solution in contact with every part by exerting gravity pressure. These experiments were watched with interest but our understanding of the processes involved was too meager to permit emulation of this courageous procedure. As the true properties of Dakin solution unfolded themselves and we fully grasped the fact that contact with purulent material almost instantly destroyed its digestive power *in vivo* as well as *in vitro*, we felt willing to investigate the subject by actual clinical means. The chart already presented shows the results. The only possible damage can result when full strength Dakin solution comes in contact with an unaltered plural surface. As this is hardly conceivable if caution is used in avoiding pressure, we arrived at the conclusion that the Carrel-Dakin method is applicable to the treatment of empyema.

Since however fluid put into the cavity under pressure may very readily force its way beyond the infected portion and gain entrance into portions of the cavity possessing normal pleura, we deprecate its use in this way. A second determining factor in this

conclusion is also found in the well known fact that irrigation of an empyema cavity under pressure with any fluid has in the past caused many cases of alarming collapse and even death. The reason for this so far as we have been able to learn is problematical but the danger is none the less real. Our later practice therefore has been to perform the usual rib resection under local anaesthesia, evacuate the pus and so far as possible remove all gross coagula of lymph. Tubes are then inserted and with the patient so placed that an easy egress of the fluid is maintained. Dakin solution is slowly run into the cavity under low pressure. Any violent coughing or embarrassment of respiration or pulse is a signal to stop the procedure. Hourly or two hourly irrigations are instituted the amount being regulated so that each irrigation washes out all that remains of the preceding and fills the cavity with fresh solution, due attention always being paid to avoiding overdistention.

Our experience leads us to believe that in this method an advance in the care of empyema has been made. The patients convalesce more rapidly, the purulent discharge ceases sooner and secondary pocketing is less frequent. In no case however have we duplicated the results reported to have been obtained in some clinics wherein well developed empyemata have been rendered surgically clean in five to nine days with secondary suture of the chest wall resulting in complete healing.<sup>1</sup>

We have not thought it necessary before this gathering to emphasize the fact that in all our work we have done our utmost to insist on the well established principles of surgical procedure in infected processes. Surgical incision in every instance takes precedence over all else. Ample drainage is never neglected. No line of reasoning bred either on our own experience or on the teaching of others has led us to accept the idea that hypochlorite acts better in puddles than in a properly arranged irrigation with drainage. We only puddle when it cannot be avoided surgically.

To sum up our studies in the mode of action of Dakin solution we believe it possesses three important properties

1 It is a powerful digestant of protein substances

This includes the protein of bacteria hence it is a bactericide

3 It stimulates wound surfaces to pour out albuminous materials and leucocytes hence it still further destroys bacteria

These three properties combined give it its undoubted power to clean the surface of infected suppurating wounds. In our experience we find its proteolytic power more important than its purely bactericidal. Hence its greatest use is in wounds in which supuration is well established and an abundance of more or less devitalized necrotic tissue is present.

A full realization of these conceptions clears away much of the misunderstanding that has been prevalent concerning the use of Dakin solution and answers the charge against it that not being specific for bacteria any such powerful bactericide must necessarily be destructive of living body tissue and thus destroy body defenses. On the contrary it destroys the bacteria and at the same time draws out locally the body defenses.

This understanding of the action of sodium hypochlorite has proved most helpful to us in applying it to our cases and in determining its field of usefulness and its limitations. In the last analysis the healing of any wound whether clean or infected is a property of the tissue involved plus the general physiological activities of the whole body. If those be deficient either inherently or relatively as compared to the virulence of infecting organism the infection cannot be controlled no matter what form of antiseptic or physiological treatment is applied. This is amply demonstrated by one case suffering from a severe thigh infection with a virulent streptococcus. The local suppuration was easily brought under control but the patient died from a streptococæmia with positive blood cultures. Anderson and Richardson<sup>1</sup> report

a similar case in which this was the final cryptic note on the chart. Wound almost healed patient dying. Again we can cite cases in which the local condition progressed satisfactorily though not ideally and metastatic infection developed in distant parts the same organism being present as that found in the original wound. Blood cultures in these cases were negative.

These considerations further lead one to the conclusion that Dakin solution is not indicated in cleanly traumatized tissues. When therefore a recently wounded patient can be adequately treated by the now established procedure of thorough mechanical cleansing and a careful complete excision of all damaged tissue and foreign materials introduced it is supererogation to apply Dakin solution. The tissues are able to cope with any remaining bacteria successfully and one is dealing practically with the condition found in a surgical wound made under the usual operating technique. Primary suture may be done with a strong hope that primary union will result. This in war conditions has been realized in from 80 to 95 per cent of the cases. In civil conditions we find this is hardly to be expected because the crushing tearing injuries inflicted by machinery and run over accidents are often more extensive even than those caused by war missiles. Care in selecting the cases has however demonstrated to us that primary union can be more often expected than heretofore had been believed.

Under all conditions however where this is sought for there will be a certain percentage of failures and active suppurations will supervene. Nothing of which we have any knowledge is then so efficient as Dakin solution in controlling this complication and restoring the wound rapidly to a condition where secondary suture may be successfully done.

Moynihan in discussing the relative merits of the Carrel Dakin treatment and primary closure of recent wounds after careful mechanical cleansing and efficient surgery states that the results are about equal. He adds

To put this statement in what may seem an extreme fashion it may be said that the

Carrel Dakin method achieved its greatest triumph in cases where it need not in fact have been applied. This does not imply as might be inferred that the method is without value. It simply means that this method is not called for in recent wounds i. e. six or eight hours after injury — those which are contaminated only but in which the contamination has not developed to an actively growing infection or suppuration. Of the treatment for the latter condition Moynihan speaks with enthusiasm and says "pride of place will cheerfully and gratefully be given to the Carrel Dakin procedure." In an analysis of the entire subject he then presents very much the views herein developed. To his teaching and to that of Morgan Sauer and Schlesinger<sup>1</sup> we are greatly indebted. They have been invaluable in helping us to arrive at what we find a most satisfactory working knowledge of this complex subject. These authors have given us a clear cut conception largely lacking in the mass of literature which has appeared in the past two years.

The use of dichloramine T has been given as thorough a study during the seven months as has the hypochlorite solution. It has not proved so efficient. It lacks the very element which makes the hypochlorite solution potent — namely, any appreciable proteolytic power. It will act as a bactericide on wound surfaces but more than this is needed. Even in this respect it has proved disappointing as compared to the more active chlorinizing agent. Many wounds kept clean on the surface with hypochlorite promptly showed a higher bacterial count under the use of the dichloramine

## CONCLUSIONS

In conclusion we desire to emphasize the two points which a study of war conditions has made applicable to our work in a civil hospital.

1. It has enabled us to get a very close co-operation between our forces and those ordinarily fully occupied in laboratory work. The practical benefit accruing to the wounded has demonstrated to laboratory men that they have an immediate responsibility in applying their knowledge to clinical problems. This responsibility they have accepted with a helpful enthusiasm which heretofore we have failed to arouse. Our studies could not have been productive without their aid. One immediate result of this co-operation has been the development by Stanley Benedict, Professor of Chemistry, Cornell Medical College of a simple, cheap and efficient method of preparing Dakin solution.<sup>1</sup> To him we are indebted for having always on hand an absolutely reliable standard hypochlorite solution. Any questions as to its correct composition were immediately answered in an authoritative way.

2. We have found in the study of traumatic infections and suppurations a field heretofore little cultivated, rich in interest and yielding a return in actual service rendered to the patients hardly exceeded by any branch of surgery within our experience.

We are fully satisfied that by applying the teachings of military surgery to these conditions a definite advance has been made in their treatment.

<sup>1</sup> See report of the Committee on the Use of the Carrel Dakin Method, Brit. J. Surg. 45.

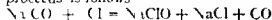
<sup>1</sup> See the report of the Committee on the Use of the Carrel Dakin Method, Brit. J. Surg. 45.



## PREPARATION OF DAKIN'S SOLUTION FROM LIQUID CHLORINE BY THE GRAVIMETRIC METHOD

BY STANLEY R. BENEDICT, M.D., NEW YORK  
PRACTICAL CHEMISTRY CLUB, NEW YORK

**T**HE best theoretical method for the preparation of sodium hypochlorite solution of known strength is to pass a weighed quantity of chlorine gas into a solution of sodium carbonate. The reaction proceeds as follows:



Weighing the chlorine used is preferable to attempting its measurement by volume for the following reasons:

1. Greater accuracy, since volume of chlorine gas is subject to change from temperature and atmospheric pressure changes.

The apparatus required for weighing the chlorine is less complicated, less readily broken, and cheaper than that required for the volume measurement of chlorine.

3. The process of weighing is more rapid and convenient than measuring the gas.

The following is the procedure for the preparation of ten litres of Dakin's solution by the gravimetric method.

## Apparatus and solutions required

1. A 100 cc. flask, graduated to 10 cc.
2. A 100 cc. flask, graduated to 10 cc.
3. A 100 cc. flask, graduated to 10 cc.
4. A 100 cc. flask, graduated to 10 cc.
5. A 100 cc. flask, graduated to 10 cc.
6. A 100 cc. flask, graduated to 10 cc.
7. A 100 cc. flask, graduated to 10 cc.
8. A 100 cc. flask, graduated to 10 cc.
9. A 100 cc. flask, graduated to 10 cc.

**Procedure.** The cylinder of chlorine is connected to the calcium chloride tube with rubber tubing. The other end of the tube is connected with a piece of narrow bore heavy walled tubing, about three feet in length. About a foot from the end this tube should reach over the balance with a suitable support to hold it at about the height of the first absorption flask, and so adjusted as to prevent the tube from slipping in either direction. Into one of the Florence flasks

placed 900 cubic centimeters of the 20 per cent carbonate solution (the solution can be prepared without undue exactness and can be measured in an ordinary graduate). This flask is fitted with a two holed rubber stopper through one hole of which passes the Folin absorption bulb bent at right angles at the top. Through the other hole passes a short outlet tube also bent at right angles. The flask is placed on the balance and the inlet tube connected with the rubber tube from the calcium chloride tube. The outlet tube is connected by means of a short piece of thick walled tubing to the inlet tube of the small absorption bottle which should contain about 90 cubic centimeters of 10 per cent NaOH and which is placed on the same pan of the balance with the Florence flask containing the carbonate. (The function of this second absorption bottle is to retain the carbon dioxide which is liberated during the action of the chlorine. Unless this gas is retained it would ultimately be weighed as chlorine.) The second Florence flask (which should have a stopper provided for it) is placed on the other pan of the balance after having been about half filled with sand or other heavy material. The stopper for this flask is also placed on the pan and water added to the flask until the two flasks counterbalance practically exactly. With a little practice this counterbalancing requires only a moment or two. Weights amounting to exactly 430 grams are then placed on the pan with the second flask and chlorine gas is passed into the first flask until the two flasks come to a balance i.e. until 430 grams of chlorine have been added to the first flask. The chlorine should be bubbled into the first flask at such a rate that not less than 20 or more than 30 minutes are required for the passage of the 430 grams. After the chlorine has been passed in the flask is disconnected from the inlet tube and from the second absorption bottle and the contents are diluted

to ten litres with tap water taking care to wash the absorption bulb and the inside of the flask thoroughly during the dilution to ten litres

NOTE — The method may be employed to advantage for the preparation of five to ten litres of Dakin's solution at one time changing the constituents used in

proportion to the final dilution. The effect of chlorine used is slightly below theoretical this being accounted for by the loss of a small amount of carbon dioxide in spite of the absorber. About 500 to 700 litres of solution have already been prepared by the above method. Never has a correction in reaction (alkalinity) had to be made and in only one trial was a correction necessary for the hypochlorite content. The latter ranges practically invariably between 0.40 and 0.49 per cent of  $\text{NaClO}$ .

## RECONSTRUCTION AND REPAIR OF THE HEPATIC AND COMMON BILE-DUCTS

### IMPLANTATION OF THE HEPATIC DUCT INTO THE DUODENUM

BY W. FRANK FOWLER, M.D., ROCHESTER, NEW YORK.

Ann. Surg. 1911, 11, 387.

PAPERS concerning restoration of the bile passages have appeared with increasing frequency of late. Surgical opinion is crystallizing as regards the best indicated procedures but there is still something to be learned from the individual case report.

Mayo (1) quotes Jacobson (2) to the effect that injuries to the common and hepatic ducts are usually due to operative trauma. Phemister (3) believes that such accidents are rather frequent and states that Kehr (4) reports sixteen injuries to the hepatic duct during one thousand cholecystectomies. The technique of cholecystectomy as evolved by Judd (5), Deaver (6), Guthrie (7) and Seelg (8) and the reference of Mayo to the anatomical relations of the gall bladder and ducts uniformly emphasize the safe isolation and section of the cystic duct and artery.

Obstruction may sometimes occur according to Mayo as a result of cicatricial contraction following gall stone ulceration. This occlusion is due to stones impacted in the cystic duct at its junction with the common duct rather than to stones in the free part of the common duct itself. Ulceration and stricture do result however from stones lodged in the pancreatic portion of the duct. Obstruction of the common duct has also been caused in two instances at the Mayo clinic by the pressure of a benign tumor of the stump of the cystic duct following cholecystectomy. Re-

moval of the tumor and the stump of the cystic duct was curative.

Walton (9) describes some of the earlier efforts to establish communication between the liver and the duodenum without reconstruction of the common bile duct. They were fantastically ingenious rather than practical.

The procedures described inadequately here which have been utilized in the Mayo clinic for the restoration of continuity in the bile passages are:

1. Excision or resection of the obstructed portion of the common duct with end to end union. Such resections require exact technique. The open end of the common duct is split along the anterior surface for one third of an inch to facilitate coaptation to the dilated hepatic duct. A T tube is introduced and the suture line reinforced by omentum or peritoneum as available. The T tube is removed in three weeks.

2. Strictured area of the common duct divided with dilating forceps. When the stricture resulting from ulceration is in the pancreatic portion of the duct it may be dilated with forceps introduced through an opening in the duct or it may be necessary to open the duodenum and expose the papilla before attempting division. After division a T tube is placed in the duct.

3. Extensive injuries to the great bile duct necessitating union of the hepatic duct



duodenum was brought up about the duct and the tube within in an endeavor to form a papilla. Packard (11) reported a case in 1908 in which benign ulceration of the ampulla of Vater had produced stenosis of the common duct. Packard severed the duct as low as possible and implanted its proximal end into the duodenum through a stab wound, folding the duodenal wall over it. Packard is probably entitled to priority in recognizing the importance of the latter procedure. Harrington (1) reports a case similar to that of Packard.

The technique employed by the writer somewhat resembles that of Mann (13) although Mann deliberately left an interval between the duct and duodenum for drainage. The writer believes that the suture line in his case should have been protected by omentum as advocated by Mayo. Fortunately however the leakage seems not to have endangered the result. Phemister states that early leakage of bile is not often harmful since the bile is usually sterile or nearly so. Nevertheless one case terminated fatally as the result of an infected subphrenic accumulation of bile which had leaked out alongside a drainage tube in the common duct.

Direct anastomosis of the hepatic or common duct to the duodenum about a rubber tube is the operation of choice in the majority of cases according to Mayo. Therefore a description of this procedure is quoted herein verbatim. When approximation of the duct and duodenum is impossible or excessive tension would be produced thereby, some other expedient must be employed. Jackson (14) overcame the difficulty in his case by making a union of the duct with the jejunum by the method just mentioned. Jackson's patient recovered without leakage of bile from the anastomosis although the suture line was not wrapped with omentum.

Walton reports a case in which he bridged the gap between the duodenum and the upper end of an obliterated common duct by means of a flap from the duodenal wall. Walton describes his ingenious operation as follows: A flap was cut out of the duodenum and turned downward. A tube was inserted into the end of the common duct and sutured

in place with twenty day chromic catgut. The opening in the duodenum was sutured in its upper part leaving only an opening sufficient to admit the tube. The tube was inserted into this opening the duodenum being drawn as close as possible to the cut end of the duct with a catgut suture. The flap of duodenal tissue was now sutured around the rubber tube so as to make a new bile duct. Catgut sutures being used. The tube was passed from the rectum on the eleventh day following the operation. Four and one half months later the patient appeared to be in perfect health. Insburg (15) suggests a modification of Walton's technique whereby the flap is fashioned with its base above. The flap is turned upward behind the tube rather than down in front of it bringing the suture line anterior instead of posterior to the tube.

Sullivan in 1909 (16) made a preliminary report and in 1912 wrote a supplementary paper (17) describing his method of experimental bile duct reconstruction in the dog. Sullivan inserts a rubber tube into the stump of the hepatic duct and secures it with unabsorbable sutures. The other end of the tube is then pushed down into the duodenum through the stump of the common duct if possible or if this is not possible the tube should project through a small incision in the duodenum about one half inch into its lumen. The duodenal walls are sutured over so that before the tube penetrates into the intestine it runs in a canal composed of overlapped duodenum. The great omentum is then drawn up so as to cover the tube. The lumen of the tube should be not less than one quarter of an inch.

Sullivan states that in dogs the passage thus formed is permanent without tendency to contraction. Microscopic examination of removed segments convinced Sullivan that the mucous membranes of the duodenum and hepatic duct grow toward each other to line the sinus between them. Mann also believes that such a tract will become mucus lined. Sullivan would expect some contraction in inflamed tissues but not sufficient to impede biliary discharge provided the canal were large enough originally. Mayo on the other

hand states that in a sinus of this character eventual contraction is inevitable

Plemister reports a case of hæmorrhage from the cystic artery during cholecystectomy due to an anomalous course of the artery. The clamp which secured the cystic duct failed to include the artery. The forceps which controlled the hæmorrhage grasped the hepatic duct with the artery and a knuckle of the duct was ligated. The usual symptoms indicative of obstruction to bile passage ensued. Three months later the precise condition was discovered at operation and the duct drained with a rubber tube. All the bile escaped through the fistula. Ten months after the second operation a third operation disclosed a necrotic and stenosed section of the duct. This portion was resected, a T tube introduced and the one half inch gap bridged with omentum. (Modified Sullivan operation). The tube was left in position for 84 days. In a personal communication (18) to the writer September 14, 1917, Plemister says: "About three months after removal of the tube the patient began having attacks characterized by epigastric pain, chill, fever and jaundice which recurred irregularly every ten to thirty days. Between attacks she felt well at first but lately jaundice has been more persistent and has been continuous for the past six weeks. I think another operation will be necessary in order to attempt to remedy the condition permanently."

Brewer (19) reports a case in which the hepatic duct and duodenum were united by means of a rubber tube wrapped with omentum after the method of Sullivan. No bile leakage occurred but there were evidences of incomplete bile passage at intervals during convalescence. The rubber tube has not been found in the stools. Brewer believes that the reconstructed duct although still functioning two months after the operation is narrowed and likely to close. In a second case Brewer (20) employed the Sullivan technique with most satisfactory immediate result. Later however it became evident that the newly formed duct was not functioning and intense cholangitis necessitated a second operation. The stump of the hepatic duct was found buried in cicatricial tissue.

In a personal communication (21) to the writer dated October 4, 1917, Sullivan writes:

"My personal experience with reconstruction of the bile duct by my method has been limited to one case, a railroad engineer of about sixty years of age operated on March 31, 1913, for stenosis of the common duct following its perforation by stones and a gangrenous process. This man since has enjoyed very excellent health and is now actively engaged in his occupation."

The question as to how great a distance the proliferating mucosa will bridge the interval between divided duct end and the duodenum is still unsettled. I am certain that it will bridge one half inch within three months. It seems essential to most men for the success of the method that the entire newly formed tract be mucosa lined. This of course is the ideal situation as it is believed this will prevent stenosis as the operation is analyzed by the accepted standards of surgical hypotheses. On the other hand I offer for your consideration the curious stubbornness of so called persistent biliary fistule which are not mucosa lined. In other words I know that biliary pressure is a very important factor in the prevention of stenosis in my operation and every effort should be directed to securing a firm walled tube in order that this pressure may be exerted while the mucosa is lining its interior.

Sullivan emphasizes the necessity of carrying out his technique essentially as he describes it and reiterates his belief that time and clinical experience will decide the value of his method. The Sullivan procedure is discussed at length because should the method prove efficient its admirable simplicity commends it.

Ginsburg and Speese report a case in which during cholecystectomy the wall of the common duct was included in the forceps which secured the cystic duct and both ducts were divided. The distal end of the common duct was tied off with the cystic artery. Post operative examination of the removed specimen disclosed the accident. A biliary fistula developed and the stools became acholic.

At the second operation nine days later the ends of the divided duct were located

but could not be approximated. A T tube was therefore introduced and wrapped about with a section of the posterior rectus sheath fascia. One week after operation bile which had been present disappeared from the stools. At a third operation about two months later it was learned that the distal end of the T tube had broken off and was impinging on the duodenal wall. The T tube was removed, a simple straight tube introduced and a fascial repair made about it. (Ginsburg is of the opinion that the employment of a T tube renders repair more difficult and the withdrawal of the tube subjects the newly formed duct to unnecessary and perhaps dangerous trauma. In this opinion Sullivan concurs.)

A fourth operation was undertaken for the relief of the upper abdominal distress and many adhesions were freed. The rubber tube was still in place nearly three months after its introduction. An attempt to remove it through an incision in the duodenum was unsuccessful. Bile leakage developed two days after operation and the stools became clay colored. The leakage soon ceased and all the bile was again delivered into the duodenum.

In regard to the use of autogenous tissue grafts to bridge a gap on the duct Walton says: "Neither the tissues of veins of fascia or even of the appendix may be able to withstand the action of the bile. Such an operation involves the use of a somewhat difficult technique and the suturing of the grafts has to be so adequately carried out that little or no leakage will take place from the line of suture." Phemister states that Lewis and Davis (2) repaired defects in the common duct of dogs with free transplants but a tendency to stenosis followed.

Mayo and Phemister are agreed that end to end suture of a duct without the use of a tube is an extremely difficult procedure. It is evident therefore that some one of the tube methods herein described would be preferable. When there is an impassable mechanical barrier either in the head of the pancreas or at the ampulla of Vater, Ginsburg believes that cholecystenterostomy is the operation of choice rather than any procedure

involving the ducts. Whenever feasible during operation upon the bile passages McArthur (23) advises the installation of normal salt solution into the duodenum thereby decreasing postoperative vomiting and otherwise assisting convalescence.

In the majority of reported cases in which a tube has been used in duct reconstruction the tube has apparently been retained. Ginsburg states that in his case the tube had not been passed four months after the operation. Mayo says however that after absorption of the catgut holding suture the tube readily passes into the bowel. Sullivan believes that even when the tube is secured with non absorbable sutures it will eventually become loosened. In one of Brewer's cases the X ray failed to locate the tube although it was supposedly still in position. It is therefore safe to assume that the tube does loosen and does pass out and that the patient either forgets to look for it or fails to find it in the stools.

It is of interest to note also that many of the reported cases are characterized by a more or less stormy convalescence with febrile reaction, leakage of bile, acholous stools, jaundice, abdominal distress or other disturbing symptoms which may or may not be harbingers of failure.

The following cases are cited on account of historical interest and because the pathology is unusual. Fullerton (24) undertook operation for the relief of symptoms indicative of complete obstruction to bile passage. The common duct was enormously dilated as a result of occlusion by the hard nodular head of the pancreas (chronic pancreatitis). The common duct was anastomosed to the duodenum by means of a Murphy button. Recovery followed.

Swun's (5) patient was a girl of seventeen who presented symptoms of bile duct obstruction and a large right sided abdominal tumor reaching to the pelvic brim below and three inches beyond the umbilicus to the left. Six pints and one ounce of bile were withdrawn through an aspirating needle. The tumor refilled and laparotomy disclosed an apparent cystic gall bladder with extensive adhesions to the intestines. Further search however revealed a normal gall bladder. An anasto-

mosis was effected between the cyst and the jejunum by means of a Murphy button Swan surmised that he was dealing with a huge common duct but was not certain. Recovery was complete. The button was not passed.

Concerning the use of the Murphy button Bevan (6) remind us that this ingenious device belong to the developmental stage of surgery. It has demonstrated the possibility of a gastro intestinal union which is now better done with the needle and thread alone. Occasionally however the button is indicated for a rapid anastomosis and may then prove life saving.

#### CONCLUSION

1 Injury to the hepatic and common bile ducts is sometime inevitable during cholecystectomy. Such operative trauma may be decreased however by a more general recognition of the necessity for careful isolation and division of the cystic duct and artery.

2 Perforation and repair of the bile duct are facilitated by the use of a rubber tube.

3 Leakage of bile does not necessarily jeopardize the result. Nevertheless the suture line should be protected by omentum.

4 No hard and fast rule of surgical procedure can be laid down. Modification are necessary to meet varying conditions.

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- MA W J Ke t t n f the bl p sa ft  
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- 3 H i t e D B R t ct n f th h j t  
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M A s g C au t f
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CONGENITAL HERNIA OF THE DIAPHRAGM<sup>1</sup>

BY WILLIAM A. DOWNES, M.D., F.A.C.S., NEW YORK

**D**IAPHRAGMATIC hernia congenital and acquired occurs much more frequently than was formerly supposed. The diagnosis of this condition can be made with little doubt by means of the X-ray. In the last few years many cases correctly diagnosed and successfully operated upon have been recorded in the literature, whereas according to Scudder (1) up to 1911 there were only six recorded instances in which the diagnosis of diaphragmatic hernia had been made previous to operation. This author states that nearly all cases prior to that date came to operation with the diagnosis of intestinal obstruction which accounted for the high mortality.

The acquired or traumatic cases have been recognized more frequently than the congenital on account of the history and sudden onset of symptoms. In many of the congenital cases the condition is discovered accidentally in the routine examination of patients that

come to the surgeon for the relief of symptoms suggestive of ulcer of the stomach, pyloric stenosis, intestinal obstruction, etc. Still others gave no symptoms of the abnormality and die of intercurrent disease, the malformation being discovered at autopsy.

Congenital diaphragmatic hernias are classified as true or false depending upon the presence or absence of a sac. The great majority of cases come under the latter group, the hernial contents passing directly through the diaphragm either through a dilated normal opening or through an abnormal opening and lie free in the pleural cavity. This variety of hernia is much more common on the left than the right side, due in part no doubt to the position of the liver. The hernial orifice is usually located at the junction of the costal and lumbar portions of the diaphragm, or at

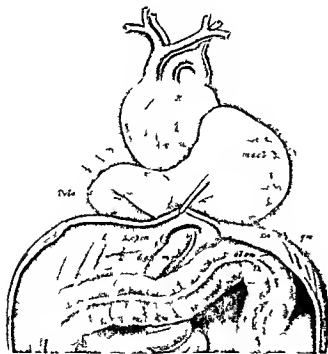


Fig. 1. Congenital hernia of the diaphragm.

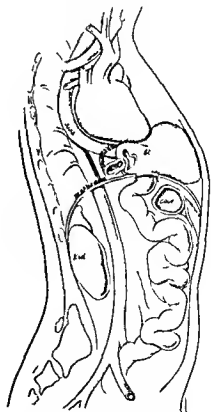


Fig. 2. Diaphragmatic section of congenital hernia of the diaphragm.







Fig 4 Roentgenogram of N.C. 6 hours after second meal. Residual still present after 4 hours

is more than offset by the knowledge gained from an exploration of the abdominal cavity and the ability to apply the correct operative procedure without delay or the added danger of a prolonged operation. Not infrequently the thoracic incision has had to be supplemented by an abdominal incision in order to restore the viscera to their proper positions or for the purpose of closing wounds of the stomach or intestine. Furthermore in the congenital cases in which the hernia has occurred through a dilated normal opening such as the esophageal opening it would be impossible to correct the condition by approach from above.

The ideal result to be desired in a case of congenital diaphragmatic hernia is the restoration of the hernial contents to the



Fig 5 Roentgenogram taken four months after operation. 20 minutes after meal

abdominal cavity with closure of the opening in the diaphragm. This will be impossible in the case in which there is complete absence of one half of the diaphragm and in those in which the organs are too fixed to permit of mobilization. In the majority of recorded cases however it has been possible to restore the organ or organs to the abdominal cavity and close the opening in the diaphragm. In a few instances where the opening was too large to close satisfactorily the stomach or omentum had been used to complete the closure.

A case of hernia of the diaphragm in which it was impossible or at least unwise to attempt reduction recently came under my care.

The entire stomach and about three inches of the duodenum had passed through a dilated esophageal opening (Fig 1). Whether the condition had



down his throat. The vomitus consisted of food recently taken into the stomach and varied in amount. The child was breast fed until two years of age. He had a severe convulsive seizure when one and one half years old and at two years of age was dropped one flight of stairs. The vomiting attacks began at some time between these two incidents.

*Physical examination.* He is a poorly nourished undersized male child. The chest is of peculiar shape, very long and narrow. Expansion is poor. The percussion note is good anteriorly although the liver dullness is very high. Cardiohepatic angle is obliterated. Posteriorly the liver dullness reaches to a four inch space. The apex beat of the heart is in a four inch space just inside the left nipple line. The heart appears to be enlarged to the right. Stomach tympany obscures dullness on the left. The abdominal examination was negative. Weight 27 1/2 pound. Tuberculin test negative. Provisional diagnosis on admission, cyclic vomiting.

*X-ray examination.* (LeWald) demonstrated the stomach to be above the diaphragm. As part of the bismuth meal was vomited the emptying time could not be accurately determined but was shown to be very slow. A bismuth enema demonstrated the colon to be of normal size and location.

*Diagnosis.* Diaphragmatic hernia (stomach).  
*Operation.* January 4, 1915. Anterior gastro-enterostomy. Intratracheal anesthesia (Lusk). A

median abdominal incision was made extending from the ensiform to the umbilicus. The liver was situated nearer the median line than normal. It was necessary to divide the round ligament in order to expose the area usually occupied by the stomach. The duodenum was seen passing through the dilated esophageal opening but no part of the stomach was to be seen. A finger inserted through the dilated opening located the stomach entirely above and resting upon the diaphragm. Traction upon the duodenum failed to dislodge the pyloric end of the stomach. In view of the very poor condition of the child it was thought best not to attempt to restore the stomach to its normal position but to perform an anterior gastro-enterostomy through the dilated esophageal opening. This was easily accomplished by drawing the greater curvature of the stomach partly into the abdomen. The jejunum was brought forward over the transverse colon and the anastomosis made about sixteen inches from the duodeno-jejunal junction. The stomach wall was anchored to the margin of the esophageal opening. Convalescence was uninterrupted. The patient was discharged symptomatically cured February 16, 1915.

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## INTRATHORACIC GOITER<sup>1</sup>

BAO F. LAMSON, M.D., F.A.C.S., SEATTLE, WASHINGTON

**N**O lesion of the thyroid gland seems to sail so long under false colors as intrathoracic goiter, which as its name indicates is lodged within the thorax and does not manifest itself externally through enlargement of the neck as other types of goiter do. Therefore it often escapes detection. It has been stated that not more than 50 per cent of intrathoracic goiters are definitely diagnosed before operation.

Respiratory symptoms being the most annoying, such patients are often treated for various diseases of the respiratory system also for aneurism or for malignant tumors of the thymus and for thymus hypertrophy, etc. For instance, a patient with a true intrathoracic goiter who came under my observation was treated for asthma at various health resorts. He even had undergone an

operation on the nasal passages to relieve him of the asthmatic symptoms which at times had been most distressing. When the presence of a goiter was suggested to him, he was very much surprised as at no time had he noticed any external signs of a goiter. However, during the act of coughing, a rather marked bulging in the suprasternal region could be demonstrated. Further examination revealed circumscribed dullness subternally in the left upper chest extending down to fourth rib.

Röntgenograms of this case showed a well defined tumor in the thorax displacing the trachea to the right, thus substantiating the diagnosis of intrathoracic goiter. Fortunately roentgenograms of these goiters usually give a rather characteristic picture and aid materially in the correct diagnosis which is not always an easy matter.

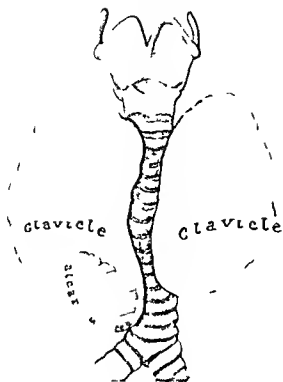


Fig. 1. The thyroid gland showing its location relative to the trachea and esophagus.

The gross pathology of intrathoracic goiter does not differ from that of other form of goiter. It may be a toxic (simple) goiter with which the individual exhibits no evidence of any disturbance of the normal metabolism which could be attributed to the goiter. Again sub-sternal goiter may be a nontoxic

with notable hyperplasia and be highly toxic in character causing the usual constitutional disturbances which go with thyroid intoxication.

The tissues of an intrathoracic goiter may undergo calcareous or through irritation even malignant degeneration.

The symptomatology of intrathoracic goiter is rather characteristic. All symptoms are mostly due to pressure on the neighboring organs produced by the enlarged gland. When portions of the gland extend between the trachea and the esophagus the trachea may be exposed to direct pressure from all sides. Pressure on the esophagus on the blood vessel in this region on the vagus and the laryngeal nerves may give rise to various and often most annoying symptoms such as respiratory embarrassment, cyanosis, cardiovascular disturbances, dysphagia and dysphonia.

Primarily patients complain of more or less acute respiratory embarrassment. They speak of being threatened with suffocation undoubtedly due to the narrowing of the respiratory channel. This will not always depend on the actual bulk and size of the gland but more on its shape and denseness. Calcareous or malignant tumors in the gland will aggravate respiratory symptoms. Pressure on the trachea may give rise to an annoying cough, laryngeal in character.

Cyanosis may accompany dyspnea. Pressure on the carotid and the jugular veins and on the vagus may aggravate the symptom. As

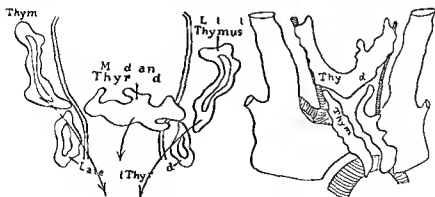


Fig. 2. The thyroid gland showing its location relative to the trachea and esophagus.

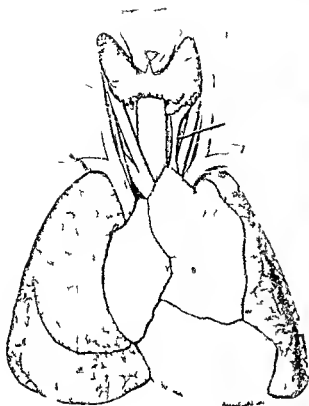


Fig. 3. Thymus gland in full time fetus had been by foetal injection (Tr. m. Cun. ham.)

the thyroid gland is one of the most vascular structures in the body any undue pressure upon this organ may cause dilatation of the blood vessels in contact so characteristic of intrathoracic goiter. Such vascular disturbance besides being the cause of cyanosis may give rise to headaches and to sensations of fullness.

Often marked cardiovascular disturbance we find associated even with simple intrathoracic goiter due to pressure on the blood vessels and nerves of this region sometimes accelerating the action of the heart and producing the so called mechanical goiter heart.

Dysphagia may occur in connection with intrathoracic goiter as the result of pressure on the upper end of the gullet or on the lower portion of the pharynx. This phenomenon is more common with left-sided goiters perhaps owing to slight curvature of the oesophagus toward the left.

Dysphonia is generally produced through pressure on the recurrent laryngeal nerves



Fig. 4. Roentgen gram showing placement and narrowing of trachea.

as they lie against the inner surface of the gland the left one being in actual contact with the thyroid gland. Finally we find that the patient's general metabolism is somewhat disturbed even though the goiter may be atonic in character.

Generally intrathoracic goiter involves but one lobe of the thyroid although it may extend to the other side of the trachea on its anterior or posterior surface suggesting a bilateral goiter within the chest.

A bilateral intrathoracic goiter just recently came under my observation which seems to be of sufficient importance to warrant a brief report.

The patient gave a typical history of intrathoracic goiter. During operation it was found that the whole gland was firmly bound to the trachea and a good sized cystic tumor occupied the end of both lobes pulling down the whole gland into the chest and naturally exerting considerable pressure in the trachea to the opposite side (Fig. 1). In this case the opposing lobe produced a vice like grip on the trachea without displacing it. Especially marked was this condition during a paroxysm of coughing when the movement of the lung forced the two opposing lobes in closer opposition making respiration most



The lumen is lost solid groups of cells appear and form the primitive thyroid follicles (Fig 2)

The thymus anlage appears as a ventral and medial prolongation of the third pair of pouches. When they are set free their lower ends enlarge and migrate also caudadly but they pass before the thyroid into the thorax and through elongation and rotation they gradually change their former location and resume a position nearly parallel with the body axis. The upper ends become attenuate and atrophy or may persist as an accessory thymus lobe. The latter may remain in contact with the thyroid (Fig 3). It is thought to be possible that the thyroid during this act may be pulled downward into the thorax. Thus the thymus may be the cause of the malposition of the thyroid when the latter is found in the thorax. Any disease of the gland in this region may be rightly termed congenital intrathoracic goiter. Such goiter is prone to escape attention or if detected by the attending physician it may be taken for a persisting thymus gland or for aneurism or for a malignant tumor.

An intrathoracic goiter may also develop from a separate accessory thyroid which may develop from fragments that became lodged in the thorax an incident not so uncommon. One of my patients had never noticed any enlargement in the neck and had no recollection of any structure within the neck becoming dislocated. During operation a goiter lower in the neck and a large cyst hidden behind the sternum was found. The gland proper was located up in the neck at the normal position. This one may be classed as a true congenital intrathoracic goiter possibly originating from an accessory thyroid gland.

In differential diagnosis nothing can be of greater diagnostic assistance than the roentgenogram and fluoroscopic observations which give a very characteristic picture.

1. A benign enlargement of the thyroid gland as a rule follows the movements of the larynx and that of the trachea during deglutition but a malignant tumor or an inflammatory growth of the thyroid usually becomes anchored to the surrounding tissues. If the

latter condition be the case the roentgenogram will show no separate shadow but the tumor in the mediastinum will be seen fused with that of the lung. On the other hand an intrathoracic goiter through its mobility and denseness of tissue will cast a separate sharply defined shadow. As the patient swallows the entire shadow will rise from 0.5 to 1 centimeter and fall again with the trachea.

Engel and Molitsch call attention to the abnormal width of the shadow cast by the organs above the heart and below the thyroid where the enlarged thyroid extends downward behind the sternum and exerts considerable pressure on the lungs.

3. The trachea may be seen to deviate from the midline. This is especially true with unilateral forms. Owing to the natural position of the esophagus slightly to the left such a displacement of the respiratory channel is especially common when the left lobe is the one extending in the thoracic cavity. In bilateral intrathoracic goiter the trachea will be found in its normal position because pressure will be exerted on its walls from both sides.

In conclusion it may not be amiss to make a few remarks regarding the operative procedure and the complications that may arise during operation. On account of the severe respiratory symptoms it is preferable to use local anesthesia whenever possible. The operative field is thoroughly infiltrated with a half of one per cent novocaine with adrenalin. This can be injected very freely. The usual collar incision is made. The capsule of the gland is opened and the goiter carefully dissected out. Blunt dissection is used as much as possible but sometimes on account of the depth of the gland it may be practically impossible to reach the lower part of the tumor with the fingers. If this be the case a tablespoon may be found very convenient and practical to complete the dissection. The intrathoracic goiters which have come under my observation have been of considerable size but it has never been necessary to divide the sternum or disarticulate the clavicle as has been advised.

Thyroidectomy for intrathoracic goiter has



a number of most serious difficulties mostly due to the position and character of the goiter and its influence on the neighboring structure. Profuse hemorrhage may occur during or after the operation. To guard against such an accident it has been my custom as soon as the goiter is delivered to prick the cavity with a hot saline prick leaving it there for a few minutes. This procedure has always effectually checked the hemorrhage. I have been most fortunate in never having had to deal with postoperative hemorrhage in such cases. Tracheotomy may be imperative at

any time during operation—as with such goiters where the tracheal wall have been subjected to constant pressure for a long period it is well to bear in mind the danger of sudden collapse of the trachea when the tumor is removed.

In spite of many serious phases of the operative procedure in intrathoracic goiter the results are among the most sensational and gratifying in modern surgery provided the removal of the goiter takes place before the surrounding structures have suffered beyond repair.

## TWO HUNDRED AND FIFTY FIBROID TUMORS TREATED BY RADIUM<sup>1</sup>

By HOWARD A. KELLY, M.D., JACOB T. THORP

THE life history of a uterine fibroid tumor has been the object of many careful studies and is well known. These tumors possess three striking clinical characteristics: they can nearly always be labeled benign; they usually give trouble either by compressing the neighboring organs or by hemorrhage, which is common; the incidence of malignancy is small and the presence of carcinomatous or sarcomatous change can almost always be excluded by a thorough curettage and the microscope.

We find also sometimes complicating diseases of the uterine tubes and the ovaries or some other incidental abdominal abnormality such as appendicitis, gall stones, gastric ulcer, etc. These complications are revealed by a thorough examination and a careful consideration of the history. In cases of persistent pain or disturbance of function in some abdominal organ a complication can be assumed. We conclude therefore that in a vast majority of cases it is not difficult to determine by a careful preliminary investigation when we are dealing with a fibroid growth of the uterus pure and simple.

The only effective method of treating fibroid tumors until recently has been the surgical, developed with such care through two generations from the days of Burnam

Kimball, Allee, Stimson, Baer, Keith, and Rice down to the present until the operation has become in skilled hands one of the safest of our major procedures. Taking an average of all operations however throughout the country as they are handled by the skilled and the unskilled, the risk to life and health is still considerable even in the simple cases. It is greatly increased in infected sloughing tumors and somewhat enhanced where the hemoglobin is below 30 per cent. In both skilled and unskilled hands there is the ever present dread of cardiac embolism often occurring about the time the patient is supine, tending the packing of her grip, happy in the anticipation of the home welcome, truly a tragic ending. With skill or without it in lesser or in greater degree hysterectomy is followed in a considerable proportion of cases by a protracted convalescence and untoward sequelæ in the shape of postoperative suppurations, adhesions, hematoma, infections of the cervical stump, ventral hernias and prolapse of the vaginal vault.

Even where there is no complication following the hysterectomy, there still remains the disagreeable and painful hospital expense while it is rare for the patient to be able to take up her routine burden of life under several months. This coupled with

the unavoidable indictment that it is after all a mutilating operation tends to make welcome some better substitute procedure

With these objections in mind my position in the past in the matter of the surgical treatment of these tumors has been not to interfere when the growth was not causing pain or discomfort through pressure nor reducing the patient through hemorrhage but to wait and watch When the tumors grew rapidly and bled excessively or where pain and pressure symptoms were pronounced I have recommended operation

In this way I have operated upon about two thousand women If then I have radically changed my viewpoint and come before you with another non surgical method of treatment you will realize that I must at least be under the conviction that I have discovered a better and a safer course

I present today a list of all cases which Curtis F Burnam and I have treated with radium with the declaration that it has favorably affected almost every uncomplicated fibroid tumor of whatever size we have had to deal with

Let me state the contentions of my thesis dogmatically and declare that we have accomplished by the radium treatment

1 Control of hemorrhage and the checking of menstruation

2 The shrinkage of the tumors

3 In many instances the disappearance of the tumors

4 In some cases (even after two years) the return of menstruation either normal or scanty

There has been no mortality causally associated with our 210 consecutive radium treated cases and 21 of these patients could not have been operated on without great danger owing to serious systemic complications Tuberculosis was present in 2 nephritis in 4 heart disease in 9 profound anemia in 4 diabetes in 1 bronchiectasis in 1 Some instances of extreme corpulency might be added to this list

As justifying these claims I present the following 10 cases of uterine fibroid treated with radium between March 3 1913 and January 1 1918

Of the 10 146 were 40 years of age and over and 64 were under 40 Let me note that contrary to the experience of X ray therapists we find it just as easy to treat effectively young women as those who are old

In addition to this list of 210 there were 45 patients admitted to the hospital during the same period where a surgical operation was elected A few of the earlier patients although there were no contra indications to radiation demanded operation or the physician chose operation owing to the comparative novelty and uncertainty as to final result of the radium treatment In the remainder there was some complicating condition The cases excluded from radiation were

Ovarian cyst	9
Appendicitis	7
Pelvis choked by big tumor and intra uterine radiation impossible	6
Severe pain	5
Adhesions	4
Operation preferred	4
Mycetozomy to preserve uterus menstruation and the possibility of conception in young women	2
Calc stones	2
Pelvic inflammatory disease	2
Cesarean section	1
Right inguinal hernia	1
Infertile	1
Intra uterine pregnancy suspected	1
<b>Total</b>	<b>45</b>

Today in the light of our greater experience not all of these 45 would be excluded from radiation It is now always possible for instance to treat through the abdomen the large tumors which choke the pelvis and make an intra uterine radiation difficult or impossible Many cases complicated by adhesions and pain are relieved of these symptoms as well as of the tumor and the bleeding A minor operation such as the repair of an outlet or even the removal of an appendix can be carried out in conjunction with the radiation Then too in a young woman it is sometimes possible to radiate away a fibroid and still preserve the possibility of conception

Where there is doubt about the diagnosis operation is to be elected as preferable to radiation

## ANALYSIS OF GROUPS

*Group 1* Pick up the first group of 146 patients who were 40 years of age and over with uterine fibroid tumors 66 are at the present time cured in the sense that the tumor has either completely disappeared or is shrunken to such an insignificant size as to be negligible.

In 48 the tumor has markedly diminished and the symptoms such as pressure, hemorrhage or pain have been relieved. This second division of our group is not static as with the lapse of time it more recent members are constantly passing over into the first division it is two thirds made up of recent cures occurring within the past two years where radium has not had time to exert its full effect.

Nine of the patients are symptomatically so well that the gynecological examination

One is reported unimproved. A fibroid tumor reaching three quarters way to the umbilicus was complicated with gall stones; an operation for both conditions was advised and refused. A single intra uterine treatment was then given and the patient never examined again till misplaced. A her lister's was mainly due to gall stone naturally she was not relieved. A second case in this group which has proved resistant to treatment had had many six treatments in Munich between February and May 1914. She was treated June 6, 1916 with 524 milligram intra uterine for 4 hours and 40 minutes and with 243 milligram for 7 hours abdominally. In February she was given 9 treatments totalling 7 hours with the following amounts: 996, 1466, 1877, 1491, 831, 1069, 131, 4466, 1066 milligrams. In May 1917, there was still some bleeding and no reduction in the size of the tumor.

In three instances operation was done after radiation: one for a complicating ovarian abscess, one because the patient continued to worry in spite of the fact that the tumor was greatly reduced and bleeding had ceased and one because a sciatica developed — thought to be due to the fibroid but unrelieved by its removal.

Although the radium treatment of fibroid

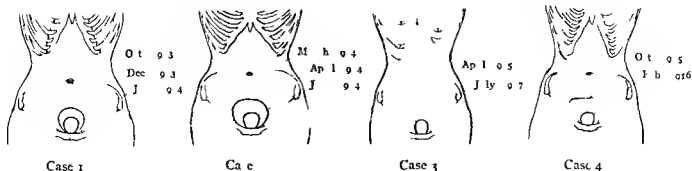
tumors has never caused the death of a patient this first group includes two patients dying shortly afterward from other causes: one a woman of 45 who died of apoplexy at her home about a month after her treatment and another an exsanguinated patient who died after inside and outside radiation two days after her arrival at the hospital.

When we add those who did not return for additional necessary treatment (4 cases) those lost sight of (8 cases) and those where treatment is too recent to report results (8 cases) the total of 146 is made up.

In resuming setting aside sixteen where data are insufficient and the patients dying from other cause we have 128 left in 123 of these radium has made the tumor disappear or diminished it markedly or robbed it of all clinical significance. In two shrinkage took place but an operation was done in one case because the patient continued to worry and in one case because of sciatica. Two were complicated by gall stones and ovarian cyst and one was recalcitrant to treatment. (The ovarian abscess occurred two years after radiation and had apparently no connection with it.)

The most obvious result of radiation is its effect on menstruation. In Group 1 8 did not menstruate after treatment 48 menstruated once 31 menstruated twice or more before amenorrhoea was established. In 2 menstruation previously excessive became normal in 7 the menopause had arrived before treatment. In 10 bleeding did not cease and treatment had to be repeated several months later to secure amenorrhoea. In 3 operations were done in 9 no accurate data as to cessation were obtainable 8 are too recent to report result.

Menopausal symptoms during amenorrhoea caused by radium treatment are not severe as a rule. In 34 no symptoms were mentioned in 3 they were moderate causing no particular inconvenience in 5 they were distinct and definite. In 7 the menopause was reached before treatment in 6 the menopause was not induced and in 3 an operation was performed. These with 11 in which there was no report and 8 too early to report results make up the 146.



**Group 2** This series includes 64 fibroid tumor patients under 40 years of age treated with radium and presents slightly different results as such patients under exactly equal dosage are more likely to have a return of menstruation after a period of amenorrhœa of a year or more

In 8 out of the 64 the tumor has either disappeared or has practically gone. In 4 of this group menstruation is known to have returned and is either scanty or normal. It may have returned in others and not have been reported as these patients are well and have not kept up correspondence. About one half are still too recent for menstruation to have returned.

In 16 instances the tumor has decreased in size. Four of these are menstruating in two the menstruation has returned and two have not ceased to menstruate.

Menstruation has stopped or has been reduced in four who feel well and refuse an examination; two are not menstruating menstrual periods in one are scanty and in one normal.

Operation was done after radiation in six. In one the tumor did not diminish and a calcified fibroid was found. In two bleeding not being controlled by one treatment an operation was requested; a submucous myoma was found in each case. In two operation was necessary because of complicating ovarian trouble. In one case an operation was done elsewhere simply because the patient insisted this was unnecessary as she was on the road to recovery.

To these should be added three from whom we have received no report, two withdrawing from treatment and five too recent to report results.

If we aggregate and summarize Groups 1 and 2 we have a grand total of 10 cases of uterine fibroid treated between March 1913 and January 1918. The average age of all these patients was 43 years; the oldest was 67 and the youngest 26. Menorrhagia, metrorrhagia or both were symptoms in 160 cases while 50 cases did not have bleeding as a symptom.

	Cases
Tumor gone or practically one	94
Tumor diminished	14
Symptomatically all no examination	13
Unimproved (1 complicated)	
Operation after radiation	9
Died other causes	2
Did not complete treatment	6
No report	7
Too early for report	13
<b>Total</b>	<b>200</b>

If we put aside the last four groups (8 cases) in which the data are insufficient we have left 182. Radium alone was sufficient in all but 11 of these to relieve the patient. In 5 of the 11 there was some other complicating condition and in 2 operation was elected. In 3 operation proved to have been unnecessary and one proved utterly resistant to treatment.

A word about the seven withdrawing from treatment. In three of these a reduction of the tumor had been secured and a favorable outcome was to be expected had the treatment been persevered in. In amenorrhœa had been obtained for several months in the reports are vague and unsatisfactory but menstruation was apparently not stopped.

Where menstruation is not stopped by the treatment or where menstruation returns before the fibroid is gone the tumor is likely to continue to grow. If menstruation stops

but returns while the tumor is still present and the tumor starts to increase in size it is always possible to continue radiation stop menstruation and again check the growth. We have never seen a tumor grow during a radium amenorrhœa.

#### TECHNIQUE

Our technique has been a gradual development. In the beginning we had no fixed notions as to dosage and method and looking backward I cannot but congratulate myself that we have had no permanent serious sequelæ.

Certain general conclusions as to effectual treatment may be stated but in actual practice no cut and dried plan is applicable. The treatment of a small differs from that of a large tumor. Where submucous fibroids obstruct the canal and prevent the ready introduction of the radium into the uterine cavity a different plan must be employed from that used in the ordinary case with a patulous cervix. Where a submucous fibroid is sloughing and others are present it is advisable first to remove the sloughing growth vaginally and then to treat the remainder by radium. Where a return of menstruation is desirable it is important to locate the ovaries and to protect them during the treatment.

It is best to produce an amenorrhœa which shall last until the fibroid is gone. It is not uncommon to see the tumor begin to grow again when menstruation is not stopped. We know from our pathological examinations and our clinical experience that the chief effect of the radium falls directly on the fibroid cell and that the shrinkage of the growth is dependent to a much less degree on the cessation of the ovarian function nevertheless amenorrhœa is an excellent guide as to adequate dosage.

As a rule a single intra uterine dose of 1500 millicurie hours is sufficient to produce an amenorrhœa and shrinkage or complete disappearance of the tumor. An equal effect is producible by a radiation with 1 gram of radium at a distance of 4 inches from the skin distributed at various points over the tumor for 4 hours. Either of these

methods may be selected or they may be advantageously combined. The amenorrhœa usually lasts from a few months to two years in some it is not secured and in some it is permanent.

It is as a rule not advisable to give more than 1500 millicurie hours inside the uterus for overdosage results in local injuries leading to persistent discharges and an occasional arthritis. There is also a great deal more discomfort from overdosage for days and some times for weeks following treatment. There is however no such limitation on outside dosage. By using a number of portals the treatment can be made ten times as strong as this average normal dose without any injury to the skin. A deep radium skin burn is a disagreeable complication. It was seen but once in this group and called for excision. An ideal treatment ought not to provoke even a slight erythema.

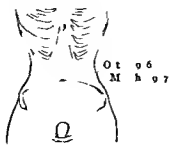
Again before taking up the detail of the treatment I wish to emphasize the importance of a careful general as well as local examination in each individual case. A preliminary curettage should be done to rule out malignancy and to remove any polyp. Calculated fibroids which are naturally not responsive to treatment can be excluded by an X-ray examination desirable in all cases.

For an inside application of 3 hours with 500 millicuries of emanation a minute glass bulb is set in the end of a short metal tube which is thick enough to screen off all but the  $\gamma$  rays. This is then screwed onto the end of an ordinary uterine sound and covered by a rubber cot. Either with or without anesthesia the cervix is dilated and the sound introduced to the fundus. This little operation may be done on the patient's bed and she is then kept in one position by means of knee pillows and sandbags. The intra uterine applicator remains not longer than half an hour on each spot and an average of six changes is made by turning once from right to left and then by withdrawing the sound 1 centimeter at a time.

In the external treatments in order to shorten the time we use from 4 to 5 gram of radium and give the entire treatment



Case 5



Case 6



Case 7

in from 5 to 6 hours. It is equally effectual to treat for an hour or an hour and a half on successive days until the desired amount of radiation is given.

In any one case the treatments internal and external can be given individually or combined in varying dosage. At least seven weeks should pass before a second treatment and it should be omitted if amenorrhœa is already secured. Usually the second treatment should be an external one.

While some fibroids show marked decrease in one month or two others disappear much more gradually. From one treatment we have seen a gradual disappearance extending over a year before its completion. At intervals of 3 or 4 months a treatment should be given to maintain amenorrhœa and to cause complete disappearance this is important. We now feel that if treatments are continued long enough the chances are that a larger proportion of complete disappearances will take place. This has not however been tested out as yet by actual experience in many cases.

#### CONCLUSION

In conclusion we surgeons ought not to be less self-sacrificing than the wise physician who struggles to put an end to the era of drugs, toxins and vaccines by sanitation and hygiene. While it is our imperative duty to continue building up our surgical technique making operations safer and carrying surgery to a successful issue in new fields nevertheless all of us I am sure are willing and anxious wherever we can do so to commit an honorable suicide a sort of a *hara kiri* of which posterity will be proud by introducing wherever it is possible

newer methods which are better and safer than surgery.

Beginning back in the fifties of the last century our predecessors at infinite cost in life and pains built up the operation of hysteromyomectomy by which so many lives have since been saved and to which also so many have been sacrificed. As long as it can be shown that an operation in a given series of cases will not only give better health but also save lives we can contemplate with mingled regret and satisfaction the necessary mutilations. This attitude of mind however is now no longer tenable for now that we have a simpler safer procedure at our disposal every death in the fibroid group becomes an indictment.

Let me also emphasize the fact that if radium fails the operation has simply been postponed without detriment. Surely the logic of the facts presented proves that henceforth radium rightly demands the first place in a determination of the best method in a given case.

#### ILLUSTRATIVE CASES

Twelve typical cases are appended in some detail. The first six consist of uncomplicated fibroid tumors of the uterus; the last six consist of cases with some serious systemic complication such as heart disease, diabetes, Bright's disease, etc.

**CASE 1 (No. 334)** Mrs. C. E. D., age 40, admitted October 20, 1913. Diagnosis: uterine fibroids, slight menorrhagia.

Examination revealed a large fibroid tumor outlined on cincholin reaching to the umbilicus. It had been noted for 2 years and had been growing rather rapidly. There had been a slight increase in menstruation but no other disturbance.

On October 20, 1913, 60 milligrams radium



round globular and freely movable reached exactly to the umbilicus

On July 3 1915 200 milligrams were applied within the uterus for 10 hours 200 milligrams to one area of the abdomen for 2 1/2 hours and 1000 milligrams to 3 areas for a total of 3 hours December 1 1915 388 milligrams to 4 areas of abdomen for a total of 6 hours

Excessive hemorrhage and severe reaction followed the first treatment By November 1915 the tumor had diminished one half she was working and feeling well In December 1917 her physician wrote that the tumor was hardly to be made out on examination and her old heart murmur seemed to have disappeared She had occasional hot flushes but these were not annoying menstruation had never returned and she was in perfect health

CASE 9 (No 547) Mrs J H B age 48 admitted May 26 1916 Diagnosis fibroid uterus *diffilis* The patient has had periods almost amounting to hemorrhages In April 1915 sugar was found in the urine

Examination shows a fibroid uterus extending nearly half way to umbilicus

On June 3 1916 507 milligrams were applied for 4 1/2 hours within the uterus 2061 milligrams for two hours above pubes January 15 1917 547 milligrams for 3 hours and 10 minutes on abdomen November 24 1917 108 milligrams for 6 hours over pubes

September 16 1916 the patient's physician reported that she had a period in July but none since the tumor was one half the original size On July 10 1917 she was examined and the entire uterus and fibroid were found not larger than a 6 weeks pregnancy She had had one or two mild menstrual periods

CASE 10 (No 2728) Mrs M H age 54 admitted August 2 1916 Diagnosis uterine fibroid *Bright's disease*

The patient had excessive menstrual flow and uremic convulsions which began two years before admission

An indefinite mass rises out of the pelvis probably a fibroid an attempt was made to trace it on crinolin but the margins could not be outlined clearly

On August 3 1916 698 milligrams were administered within the uterus for 3 hours May 5 1917 435 milligrams for 2 hours

On December 12 1916 her physician wrote that there had been no bleeding since September and that the tumor was one half its original size May 25 1917 no tumor could be made out however as she had had one bleeding of moderate amount it was thought wise to treat again

CASE 11 (No 3291) Miss R B age 37 was admitted May 22 1917 Diagnosis large fibroid tumor of the uterus hemorrhages double mitral murmur and dilated heart with frequent attacks of tachycardia

The symptoms began 2 years ago with hemorrhage The periods came every 4 weeks lasting 10 to 12 days with a brownish discharge between periods On examination a fibroid tumor was found reaching 1 inch above the umbilicus

The treatments given were entirely abdominal May 22 1917 537 milligrams 600 milligrams and 1125 milligrams for 3 hours May 4 1917 1585 milligrams for 5 hours

May 6 1917 1191 milligrams for 5 hours  
May 27 1917 1043 milligrams for 6 hours  
May 28 1917 1481 milligrams for 6 hours  
May 31 1817 917 milligrams for 4 hours  
June 1 1917 820 milligrams for 3 hours  
July 25 1917 1400-1065 milligrams for 4 hours  
July 26 1917 3418 milligrams for 4 hours  
July 27 1917 236 milligrams for 4 hours  
July 28 1917 1780 milligrams for 3 hours  
July 30 1917 666 milligrams for 4 hours

Results The first series of treatments reduced the periods and the bleeding A second series was given January 2 1918 the patient showed marked improvement in the cardiac condition the entire uterus and fibroid were reduced to the size of a large orange and there was no irritation of the skin

CASE 12 (No 3486) Mrs W T B age 55 admitted September 10 1917 Diagnosis uterine fibroid menorrhagia *bronchiectasis*

The patient had excessive bleeding at the menstrual periods as well as hemorrhage and discharge from lung ulcers On examination a fibroid of the uterus was found The uterus was 3 times normal size

September 10 1917 1150 milligrams of radium element was applied for 1 hour within the uterus The patient had one menstrual period after treatment then amenorrhoea December 3 1917 the husband wrote that she had no further bleeding and seemed cured although she still suffered from the lung condition



CANCER OF RECTUM<sup>1</sup>

B. JEPOMI M. LANCH, M.D., FACS, NEW YORK

CANCER of the rectum and colon has increased 100 per cent in the past fifteen years according to the *Report of Vital Statistics of the Registration Area of the United States*. Bloodgood has well said that in the life history of every malignant growth there has been a moment when it was surgically curable and the lesions under consideration offer no exception to this admirable axiom. To recognize and to seize upon this precious moment is no less than to control the life of the afflicted individual.

*Result of surgical treatment.* Of 491 cases studied we have operated upon 35. The hospital mortality was 16 per cent. Forty-one have lived one year, forty-five two years, thirty-three three years, twenty-two four years, twenty-five and seventeen six years.

Patients not replying to circular letter have been classified as dead when last heard from. As in all clinics situated in cosmopolitan center where the population is in constant flux it is impossible to follow a large number of the patients. Thus the statistics as above created are necessarily less favorable than if every case had been followed to date.

Whatever disability exists as a result of operation does not interfere with livelihood gaining. One of our patients who has bankrupt when his rectum and sphincter were removed and who is incontinent at times has made four trips to Europe and has earned over a million dollars since operation. We cannot overemphasize the plain fact that postoperative conditions no matter how unfavorable as to function do not interfere with the usefulness or economic independence of the patient.

Incontinence is a relative term. Its importance has been grossly exaggerated. As no horse is sound, so no human body is without defect and even great defects are compensated for by the natural endowment of the individual to meet such obligations. It is simply a question of getting used to the discomforts of a colostomy or a leaking anus.

a psychological phenomenon well worthy of consideration. Think of the innumerable women to whom childbirth who have been incontinent for a quarter of a century yet who efficiently and without affront to their families perform their daily work. Because of this psychological element we strongly prefer to have a relatively incontinent normal anus rather than to have an artificial one upon the abdomen.

This briefly is the result of surgical therapy in our series.

What stronger argument could there be for discussing the diagnosis and the indications? These statistics show that rectal cancer operated upon even after great delay and by poor methods is not hopeless. If with these limitations we obtain result how important therefore is the early diagnosis and how promising the outlook for the future.

What have been the method of study in this series of 491 cases? Of first importance is a flat contradiction of some still prevailing convictions, namely that the operation is hopeless, that the cancer patient is cachectic or has lost weight, that age is of importance, that pain is a prominent symptom and that a tumor can always be felt. The very occurrence of these symptoms spells inoperability.

What are the important symptoms from the modern standpoint in order of diagnostic and therapeutic importance?

1. Constipation. This we believe to be the very first and earliest of all symptoms. It is undoubtedly protective in type, being perhaps the result of biologic reaction to the influence of the new growth. There are however several hypotheses as to its origin depending upon the path of inhibitory transmission rather than upon its origin or occurrence. Of the latter and of its protective nature there can be no doubt. Certainly it is not due to mechanical obstruction of the growth.

Stomach symptoms. We have repeatedly referred to the cases esoteric as contrasted

to hæmorrhage and the like which are exoteric. Chronic indigestion so frequently a sign of peripheral pathology is just as significant of rectal cancer as of a chronic appendix.

3 Blood or bloody stools. This is usually the first exoteric sign. It can occur without ulceration in which case it may be due to a blocking of the return circulation in the valveless veins leading to the liver. In any event hæmorrhage so commonly associated with cancer (10 per cent of our 491 cases had been operated upon previously to our seeing them for hæmorrhoids) is a frequent source of the blood. In a large proportion of the cases however it is due to ulceration.

4 Frequent and imperative desire to move the bowels followed by explosive discharges of gas, blood and mucus. This symptom is usually spoken of as the diarrhæa of cancer. It is not in reality a diarrhœa in that feces are rarely passed.

These are the classical symptoms which every gastro-enterologist should know. Other symptoms occasionally noted are an indefinite pelvic discomfort and pain or tenderness over the cæcum which has been mistaken for right-sided pathology.

*Diagnosis.* A patient presenting any one of the above symptoms should have a rectal and proctoscopic examination as a matter of routine. In our series of 491 cases 56 per cent of the tumors were within 7.5 centimeters of the anus, 69 per cent were within 10 centimeters of the anus and 31 per cent were oral to this. It is quite evident therefore that more than one half were within reach of the finger that two thirds could have been diagnosed under anesthesia by the finger and that all except the sporadic cases in the colon could have been diagnosed by the procto-cope.

The duration of symptoms for this series was eight months. During this period many of the cardinal diagnostic symptoms already referred to had been present so that at any time a diagnosis could have been made had the patient been properly examined.

*Age.* In our series of 491 cases 4 per cent were under thirty years of age, 7 per cent thirty-five. According to the United States Bureau of Vital Statistics 0.5 per cent of the cases of rectal and colonic cancer were in

children under nine years of age, 2.75 per cent under nineteen years, proving that cancer is not confined to any age and that while it occurs more frequently in middle life still for all we must recognize the danger of placing too much importance on age.

A word must be said regarding the pernicious habit of biopsy for diagnosis. In the symposium on Inoperable Cancer at the New York Academy of Medicine Robert Abbe remarked that in the treatment of carcinoma by radium the biopsy wound itself was one of the last to heal and was very stubborn.

*Treatment Operability.* In our series of 491 cases extending over a period of nineteen years 153 were considered inoperable. Of great importance is the history of the advance of our technique and a more liberal understanding of the possibilities. From a study of unexpected results in many so called inoperable cases we are convinced that even in the late cases except when the peritoneum is involved there is always a fighting chance. Of the 153 cases considered inoperable none has been so classified because of the extent of involvement in the rectum itself.

Our operability for the total number is 60 per cent. This high percentage is due to the fact that Tuttle kept no record of inoperable cases. By operability is understood radical extirpation of the growth. In the past five years our operability has risen to 74 per cent. Let it be clearly understood that this refers to growths strictly localized in the rectum. As to the indications for radical treatment when adjacent organs are involved our statistics show that we have often removed a part of the vagina, a part or the whole of the prostate, seminal vesicles, urethra and uterus, several coils of intestine and part of the bladder. In many instances it is necessary to perform an exploratory laparotomy to determine whether the growth is operable.

*Choice of operation.* (1) combined (2) perineal (3) abdominal. We have performed the combined operation 111 times in 36 of these cases it was performed in two stages. It is our operation of choice.

The perineal has been performed 10 times, the abdominal 20. Formerly we used the fol-

lowing operations now in di use. Kraske 20 modified bone flap 3 and intrarectal 18. When possible for the psychical reasons already described we always place the anus at the normal site. We prefer to perform the operation in one stage if it is possible but if neces ary we divide it into two stages.

The perineal operation is our operation of choice in very fat or in extremely debilitated people. In all cases as a matter of routine we always remove the coccyx. Preliminary colostomy is always done when the growth is within centimeter of the anus in order to prepare for the extensive removal *en bloc* necessitated by lymphatic involvement.

We have for some time abandoned rectal resection for the reason that in all of the cases the operation has been followed by stricture. This is due to the presence of a terminal blood supply in the rectum rather than as commonly supposed to the absence of peritoneum. Exceptional work on dogs has been done by Barber which has confirmed us in this belief. It is the is hemic rather than the peritoneal denudation that produce the stricture. It is axiomatic that the amount of scar tissue is in reverse ratio to the blood supply.

*Illustrative operative treatment.* What can be done in this type of case is still of great importance. Until earlier diagnoses are made many cases will continue to fall in this class. If this paper served no other purpose than to convince the profession of the necessity of early colostomy in inoperable carcinoma of the rectum it will have done some good. The fixed attitude toward colostomy is that it should be postponed until obstruction supervenes. This is certainly not in accord with the facts as we find them in 36 cases for cancer alone and in more than 100 for other conditions. It can be done under local anesthetic

What are the advantages of early colostomy in inoperable cancer as opposed to the supposed disadvantages? It reduces the inflammation often converting an inoperable into an operable case. It obviates intestinal obstruction and its accompanying symptoms of pain, constant secretion and defecation, permits rest and sleep and insures recuperation. The patient renews his normal routine as to habits and diet. It stops hemorrhage. In short it places the parts at surgical rest. If early it is without notable mortality. If late this rises to 40 or even 50 per cent.

*Local cauterization.* This is frequently of great value. It stops pain and limits secretion and odor. If frequently repeated it may keep a patient alive for many months.

Treatment by radio active substances, fulguration and by biochemical derivatives is not here considered.

#### CONCLUSIONS

1. We would urge that digital and proctoscopic examinations be made routine in all patients presenting gastric or intestinal symptoms. If this is done a great many cases will be diagnosed early and saved.

2. That all cancer cases should be referred to a surgeon as he is best fitted to pass judgment as to whether they are suitable for operation or not.

3. If operable colostomy should be performed as soon as possible thereby saving much suffering and discomfort.

4. That no patient should be denied a radical operation until it is proved beyond doubt that it is not justifiable.

5. That our technique is now more perfect and consequently we are saving many cases which previously died from shock and peritonitis.

## A PRACTICAL METHOD OF FOREIGN BODY LOCALIZATION

BY CAPTAIN ARCHIBALD H. BUSBY, MEDICAL CORP. U. S. A.  
 Chief, X-ray Department, H. P. I. N. O. (New York City)

FOREIGN bodies in war surgery may be grouped into two classes: first those of fresh wounds which are operated upon and removed at or near the front and second old foreign bodies which are those that have for one reason or another been passed to the rear without removal. The radiologic technique close to the front is practically all fluoroscopic. Where scores of wounded are continually passing through speed is a most important factor and if results are to be satisfactory accuracy must be maintained. When one realizes that there may be numerous foreign bodies in a single patient that they may be grouped or scattered, some movable, others difficult of access and still others complicated, that time given to each case must be reduced to a minimum, then some of the difficulties and problems can be appreciated that must be met in war service as compared to civil practice.

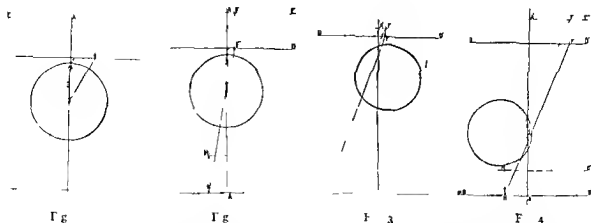
Much progress has been made in foreign body localization during the war for various methods have been perfected, considerable apparatus has been devised and special tables which combine localizing and operating have been developed. These tables mark a great stride in advance. Methods for foreign body localization are often complicated or the technique is extensive. They may involve mathematical problems, the making of plates, the drawing of diagrams, the setting of apparatus, the removal of the patient and also the measurement of distances such as from the screen to the skin, the tube from the table, the excursion of the tube and the excursion of the shadow on the screen. Profundometers, the Hirtz compass, Sutton's spears, *lecran*, *perce* of Hirtz and Gallot, etc., all have their value and uses but there are two factors which stand apart and must be considered if good results are to be obtained: first accurate depth localization, second the operation should be performed with radioscopic guidance.

The latter will always lead directly to the foreign body; will follow a movable body and will indicate any change of position that may be caused by the dissection or retraction.

In the removal of old foreign bodies the speed of localization is not so important; consequently more complicated devices may be used for special cases that require more detail and deliberation such as the making of plates, the setting of a compass, etc. Yet a practical and simple apparatus is always desirable for routine work. The method of operating is a matter of selection by the surgeon.

The method herein described will enable the operator to ascertain the depth of foreign bodies in a simple practical manner, eliminating all mathematical problems, the reading of compilation of charts at the same time, minimizing the technique and thereby removing many possibilities of error. It is not necessary to know the distance of the tube from the patient, nor the distance from the screen to the skin, nor the distance the tube moves on a horizontal plane. Any actual measurement of these factors may be disregarded; yet the correct depth of the foreign body may be read on a scale of millimeters immediately after the operation is completed.

This method is based on the fact that the two opposite sides of the parallelogram are equal in distance, one from the other as described by Barret and Andrault. Figure 1 shows that if a straight line is drawn from *H* directly to the center of the circle, a continuation of the same line will intersect the horizontal line *DD'* at point *F*, which is a certain definite distance from the central vertical line *AA'*, as will also point *H* bear a definite relation to line *AA'*. Another line drawn parallel to the line *HF* but passing through a point on the periphery of the circle exactly above the center will intersect horizontal line *EE'* and the line *CC'* at the same distance from the central line *AA'* as the



first line  $HF$  if the horizontal lines Nos are an equal distance from lines Nos 1 each of which must be equal to the distance from the center of the circle to the periphery. In other words if point  $H$  is to be the same distance as point  $H$  from line  $A$  1 the distance from  $H$  to  $H$  must be the same as from the center of the circle to the point directly above on the periphery of the circle. If point  $F$  is the same distance from line 1 1 as point  $F$  then the distance between  $F$  and  $F$  will be equal to the distance from the center mark to the periphery mark of the circle. The distances between these three sets of points will equal each other.

A working application to this diagrammatic sketch Figure 1 may be indicated by assuming that the circle is the patient. The point in the center of the circle is the foreign body, and the line  $DD$  is the fluoroscopic screen above the patient. Point 1 will be the first position of the  $\lambda$  ray tube giving the central ray in a vertical line upward directly to the foreign body (center of circle) shadow of which will appear on the horizontal screen at point where line  $AA$  crosses line  $DD$ . If a piece of opaque substance is placed at the periphery of the circle directly over the foreign body the shadows of the opaque marker and foreign body will be superimposed showing only one shadow on the fluoroscope  $DD$  over central ray  $AA$ . While the fluoroscope remains absolutely fixed the tube is next moved on a horizontal plane from point  $A$  to point  $H$  and fixed there. This may be termed the second position. The central

ray passes vertically upward from this point  $H$  and the foreign body at center of circle now interferes with an oblique ray thrown in a shadow on the fluoroscope  $DD$  at point  $F$ . The opaque marker also throws a shadow upon the fluoroscope which is disregarded for the present. A small piece of lead or other opaque substance or a set of crossed wires may be used on the screen to locate precisely the shadow of the foreign body at point  $F$ . This spot so marked is to remain fixed in its position when the shadow of the foreign body passes on with the next movement. The tube as described above has been fixed on the horizontal plane in the second position and can be placed in the third position only when the tube and fluoroscope are so arranged on a standard or table that they both move simultaneously as a solid body when raised in a true vertical line. It must be so raised until the shadow of the opaque marker on the skin (periphery of circle) coincides accurately with the spot marked on the screen that has been fixed at point  $F$ . When this has been accomplished point  $F$  and the third position have been established. The distance that the screen and the tube has been raised will be equal to the depth of the foreign body (center of circle) from the point marked on the skin (periphery of circle).

Figure 2 when compared with Figure 1 shows the horizontal excursion of the tube from the first position 1 to the second position  $H$  considerably more restricted yet the distance that the tube and the fluoroscope have to be raised in order to be placed in the

third position is exactly the same as in Figure 1 that is the distance from the lines Nos 1 to the lines Nos 2 in both cases is the same. In this way the fact is demonstrated that the horizontal movement of the tube from the first to the second position is variable consequently there is no necessity for measuring the distance but the greater the excursion the more the shadows move on the fluoroscope and the more readily is made the adjustment of the third position the more the excursion is restricted the less the shadows move on the fluoroscope and the more exact will have to be the technique. A movement of fifteen to twenty centimeters has been found very satisfactory.

Figures 3 and 4 show that the method may be applied to all parts of the body and at every depth but the central ray must always be used directly under the foreign body as shown by vertical line 11. In Figure 3 the foreign body is near the top of the circle and somewhat to the left side. Figure 4 shows the foreign body in the lower portion of the circle and further to the right side. By comparing Figures 3 and 4 it will be noted that in Figure 3 the source of the ray or line  $BB'$  is a considerable distance below the circle and the fluoroscope or line  $DD$  is quite close above the circle. In Figure 4 the reverse is shown the line below  $BB$  is closer to the circle and the line above  $DD$  is farther above the circle yet the distance the tube and fluoroscope is moved from the second to the third position is equal to the depth of the foreign body in each case.

Figures 1, 3 and 4 demonstrate the following that the depth of the foreign body is equal to the excursion of the fluoroscope when the tube moves simultaneously with it from the second to the third position that the distance the tube is moved on the horizontal plane from the first to the second position need not be measured that the actual distance of the tube below the patient is variable that the distance from the skin to the fluoroscope may be optional and adjusted at the convenience of the operator and that all depths of foreign bodies in every location may be determined.

Figure 5 represents the working application

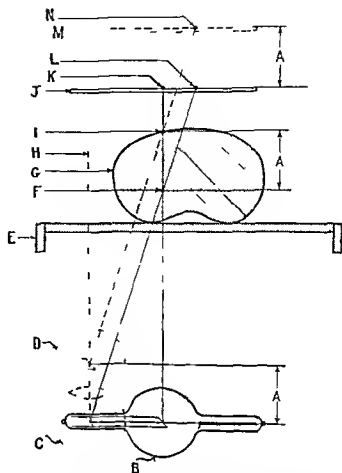


FIG. 5. 1. Equal spaces between excursions of tube excursion of fluoroscope and distance from skin to foreign body. B tube in first position. C tube in second position. D tube in third position. I table. F foreign body. G body of patient. H central ray from tube in second position. J opaque marker placed on skin directly over foreign body on central ray. J fluoroscope in first and second positions. A shadow on fluoroscope of both foreign body and opaque marker placed on skin. I shadow which superimpose each other. L shadow on fluoroscope of foreign body with tube in second position. M fluoroscope in third position. N shadow of opaque marker on skin with tube in third position. Spots N and L are directly the same upon the fluoroscope.

of this method showing the X-ray tube table fluoroscope patient and foreign body. The tube B is in the first position with the central ray passing in a vertical direction to the foreign body F in the body of patient G which foreign body offers an obstruction to the ray casting a shadow on the fluoroscope in the first position A. Point I on the skin is next established with the aid of the central ray a metallic pointer or guide on the skin and fluoroscope. This will be exactly above the foreign body so the shadow of the opaque marker placed on the skin at this point and

the shadow of the foreign body will be superimposed at the point *A* on screen *J*. The tube is next moved on a horizontal plane to the second position *C* which will send the central ray directly upward *H* but the foreign body will obstruct an oblique ray from the tube in the second position that will throw a shadow on the screen *I* at point *L*. When the tube and screen are simultaneously raised on the same vertical carriage from the second position *C* *J* the shadow of the foreign body will leave point *L* and will be disregarded while the shadow of the opaque marker on the skin *I* will approach the registered spot on the screen point *L* where the shadow of the foreign body was and the carriage must be raised until this shadow is exactly centered on the point which is indicated by the intersection of two cross wires *V*. Point *A* on screen *W* is the same spot as point *I* on screen *J*. The screen has merely been raised with the tube. This completes the operation and is called the third position.

The apparatus with which the practical application of this method has been proved was aided by light improvised additions to the Waite and Bartlett rect tube standard. The arrangement was very crude a photograph of which is shown in Figure 6. The additions made were the fixation of the fluoroscope *A* to travel vertically with the tube *B* a guide *C* on standard so that the carriage of the tube and fluoroscope should travel in a true vertical line and a measure *D* in millimeters on the immovable standard post with an index *E* on the movable carriage *G*. Figure 7 shows the application of this modified tube stand so that it may be used with any ordinary fluoroscopic or wooden table. The table should be stationary (without wheels) for any decentralizing movement of the table or patient during the operation would result in a false reading. The method that the operator employed for marking the point on the skin directly over the foreign body using the central ray in the first position is shown (see metallic pointer *I* in hand of operator). A lead screen may be used in front of the operator from the floor to the level of the table. With any foreign body localization the screen work is most important. It is best

therefore so to arrange the apparatus that both speed and accuracy will be developed. One that will answer the requirements is found in a modified Dessane's screen as shown in Figure 8. The screen is set in a frame which permits a horizontal movement in a transverse direction to the length of the table. Upon the glass of the screen are fixed two wires which cross at the center point of the screen. The shadow of the foreign body is located with the central ray and placed so that the center is at the intersection of the cross wires with the screen in the central or neutral position (see point *A*). The screen is raised on hinges (see *A*) the horizontal bar is placed in position and the pointed director is passed through the central sleeve down to the skin. The opaque marker which is on a piece of adhesive with the center hole corresponding with a hole in the adhesive is placed under the point of the director and fixed to the skin (see *I* Fig 8). The director and cross bar are next removed the screen replaced and the central ray used again to ascertain if the shadows of the foreign body and opaque skin marker correctly superimpose each other thereby verifying the accurate placement of the marker (see point *A*) which is the screen picture of the first position. The tube is next placed in the second position which moves the shadow of the foreign body away from the center. The screen is now moved horizontally so that the cross wires again pass through the center of the shadow of the foreign body. This registers the point on the screen which is fixed for the second position *L*. Figure 5 and the third position *A*. Figure 5, as it is also the same spot that the shadow of the foreign body leaves and the shadow of the opaque marker *A*. Figure 8 takes its place at the completion of the third position. It is better to use a screen such as is described above but not essential. One may use any screen if provision is made for registering the shadows and also if provision is made for placing the opaque marker accurately on the skin.

Figure 9 shows the sketch of a Gaiffe military radiologic table used for localizing the depth of foreign bodies and also for operating with fluoroscopic guidance. This sketch

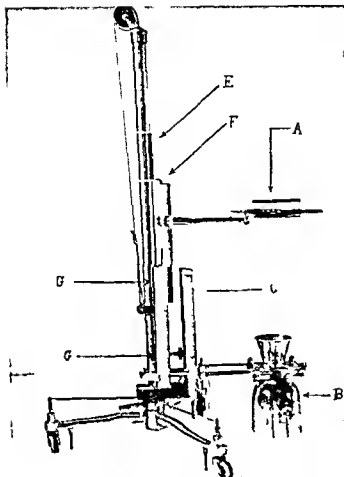


Fig. 6. Apparatus assembled for foreign body localization.



Fig. 7. Showing application of apparatus.

shows the table so modified that the method herein described may be used with it and still the original purpose of the table is not in any way interfered with. The table is made so as to be portable with folding legs and detachable parts. The carriage sleeve *I* which carries the fluoroscope and tube in its vertical excursion rides on the outside erect rod *B*. The fluoroscope arm is adjustable in height by a tight clamp on the carriage sleeve and carries also a sliding clamp that encircles the inner erect rod or guiding rod *C*. The arm holding the tube is attached to the lower end of the sleeve by a thumb screw and thus allows a sliding clamp which passes around and rides on the inner erect or guiding rod. The carriage carrying the arms is raised (or lowered) from the second to the third position by the cog arrangement of hand wheel *D*. The tube when placed in the holder must be centered on the smallest possible aperture of

the diaphragm with the aid of an opaque plumb bob or apparatus made for adjustment of the central ray so that the tube may remain centered and always be ready for use without further adjustment.

The apparatus is arranged in such a way that a search for foreign bodies may be very quickly made over any part of the whole body. The tube may be placed under any particular foreign body and the foreign body may be placed over the central ray by using a small aperture in the diaphragm. The diaphragm is enlarged and the fluoroscope is placed so that the first position of the foreign body shadow is registered by cross wires on screen (see Figure 8 *A*). The spot on the skin is marked (see Figure 8 *I*) and the shadows of the foreign body and opaque marker will superimpose on screen (see Figure 8 *A*). The tube is moved to the second position and the shadow of the foreign body registered





point so that both shadows superimpose. This is the first position.

3 Place the tube in the second position and register shadow of foreign body on screen.

4 Place the tube in the third position and register shadow of opaque marker on screen.

5 Read on erect standard the depth of foreign body from point marked on skin.

Having determined the depth of the foreign body, the best results are obtained for the removal of foreign bodies when the operation is performed on a radiologic table. With the use of the X-ray, the radiologist using a metallic sterile director and Dessine bonnet is able to direct the surgeon both as to the point of entrance and the location of the foreign body during the operation. In this way the surgeon has the benefit of operating in unrestricted light. Another method is for the surgeon to operate in a darkened room with the aid of an orange light using the fluoroscope himself as a control at various steps of the operation. It is not usually used in cases where a difficult dissection is anticipated, but it is very useful when the foreign body is to be removed through the tract of the wound in fresh cases and when the foreign body is to be removed by the puncture

method. The Sutton puncture or spear director method may be used in cases in which the puncture is not contra-indicated. It is often desirable to use the Hirtz compass which is of very great value, but the technique and time involved for each case prevents the use of it as a routine measure on an active service.

#### CONCLUSIONS

In conclusion I would urge that consideration be given the method described for determining the depth of foreign bodies because of its practical value and because—

1 The screen work is similar to that used with other methods.

A radiological table may be so modified as to use this method without interfering with its original purposes.

3 The method may be used either on a table complete or on a separate erect tube standard.

4 Speed is facilitated and accuracy maintained.

5 No mathematical problems, calculations or measurements need be used.

6 The actual depth of the foreign body may be read in millimeters immediately the operation is completed.

INFLAMMATORY NOULASMS OF THE INTESTINE SIMULATING MALIGNANCY<sup>1</sup>

B. NATHANIEL M. JONES, M.D.

A. A. EISENBLIG, M.D., CLIN. N. O.

THE differential diagnosis from gross morphology between inflammatory processes and malignant disease not infrequently present considerable difficulty. Certain chronic inflammatory changes of the bowel for instance, fecal diverticula or chronic diverticulitis present grossly much the appearance of carcinoma. Chronic post-traumatic peritonitis is sometimes difficult to differentiate from a malignancy but it is in the long-standing inflammatory processes of the gastrointestinal tract that the confusion most often arises.

Many cases of peritonitis on the basis of old ulcer have been clinically diagnosed as carcinomas. A long ago in 1833 Virchow called attention to isolated inflammatory masses in the wall of the colon. Hermann (2) has referred to gross similarities between inflammatory masses arising around ilio-ligatures in herniotomy, hysterectomy and the stump of the omentum to malignant disease. Teddenty (3) in 1909 published an interesting article in which cancer and inflammatory tumors in the abdomen which he divided into four categories: (1) interstitial colitis caused by circumscribed hypertrophy and stenosis; (2) simple percolitis; (3) diffuse percolitis; and (4) adherent percolitis. He instances the case of a man 49 years of age who had long suffered from leukorrhea, constipation and emaciation with blood and mucus in the stool. There was a hard tumor in the umbilical region which was cured by the use of creosote and salicylic acid. Mayo Robson (4) is of the pathologic opinion that the chronic inflammatory colitis probably due to infection spreading through the intestinal wall and he speaks of two varieties: the chronic adhesive in which the onset is acute and the chronic inflammatory in which the onset is slow. He reports numerous cases in five of which with patients supposedly suffering from carcinoma of the sigmoid or rectum the growth

disappeared after colostomy. He also mentions the fact that cases recovered under hot topical applications.

Studies at the Mayo Clinic seem to indicate that the masses are usually on the basis of chronic inflammatory processes around diverticula. Diverticula have been found in every part of a digestive tube from the esophagus to the anus and their presence frequently gives rise to inflammatory tumors. Ciffin (5) reports 7 such cases in five of which carcinomatous degeneration was found on microscopic examination. C. H. Mayo (4) reports 17 cases of diverticula of the appendix itself. Pathologically these processes give rise to marked proliferation of fixed connective tissue either diffuse or localized in nodules and the starting point is almost invariably the submucosa or muscularis. It is rather striking that the mucosa usually escapes unless injured by pressure atrophy brought about by contraction of newly formed fibrous tissue. Kauffman (5) by especial stress upon the fact that histogenetically such chronic inflammatory reaction of the gastrointestinal tract differ very materially from infections of other organs in that the mucosa is spared until late in the process. In fact McGrath (6) speaks of such conditions as extramucosal.

As indicated above such inflammatory processes are at times differentiated with difficulty from certain other pathological conditions notably diffuse carcinoma and the infectious granulomata.

A striking case of this variety was recently under my care and charged with a double error in diagnosis.

F. S. St. John Hospital No. 169, Agra, by occupation an American by birth 33 years of age admitted referred by Dr. John M. L. Chinn and H. A. Berke. Operated upon by N. M. J.

The family history is of no importance in case of tuberculous or malignant origin. In the present history up to one year ago there is nothing of importance. He has suffered from no

acute or chronic infectious diseases and there has been no history of venereal infection. About July, 1916 he suffered a severe attack of pain in the right lower abdomen accompanied by nausea, vomiting and chill and fever which was diagnosed by his attending physician as acute appendicitis. He was confined to his bed ten days at that time but not operated upon. Several minor attacks of pain of short duration were suffered until about the middle of April, 1917 when he had a rather severe attack of shorter duration. Since then there have been numerous such attacks in the region of the appendix. Three days before presenting himself for examination for the selective service in August he began to have pain again in the abdomen. This increased in severity but on the afternoon of August 14 he presented himself for examination and Drs. MacLachlan and Berkes the examining physicians diagnosed an acute attack of appendicitis and referred him to me for operation. His temperature was 99.4, his pulse 108. He was a fairly well nourished man. His teeth were in rather poor condition but there were no other evidences of oral sepsis. His pupils were equal and reacted equally to light and accommodation. There was no general glandular enlargement and his reflexes were everywhere present and normal. The heart and lungs were negative. The abdomen was not distended but presented a condition of board like rigidity over its entire extent with extreme tenderness in the right lower quadrant. Deep palpation of the abdomen was not possible on account of the rigidity and tenderness. He was directed to go immediately to the hospital but did not present himself until the following morning. At this time his temperature was 100.4 and his pulse 100, blood count 7000 and the examination of the urine showed nothing abnormal. The abdomen presented the same conditions as on the previous afternoon. Operation under anesthesia ether administered by W. E. Cernhart. After the patient was anesthetized one could palpate a large indistinct mass in the right side rather lower than McBurney's point. A McBurney incision was made and upon opening the peritoneum and introducing the hand great difficulty was encountered in making out landmarks. After considerable search a large hard mass was felt densely adherent to about the brim of the pelvis. It was necessary to enlarge the incision and the better exposure thus obtained showed the lower ileum and the cecum to be buried in a mass of firm adhesions. These were freed with great difficulty and it was then found that about 2 1/2 inches of the lower ileum and the cecum composed a very dense and extremely hard tumor mass. The mucosa of the lower ileum was extremely thickened and numerous enlarged glands could be felt. The appendix could not be identified. The gross appearance was that of a carcinoma of the intestine though the possibility of tubercular actinomycotic or chronic inflammatory process was considered. The entire mass was re-



Fig. 1. Cross section of cecum. No mucosal structure recognizable. The glands are completely atrophied through hypersecretory activity. There is an enormous increase of connective tissue everywhere and areas of round cell infiltration.

sected and an end to end anastomosis was made between the ileum and the colon. Rather large raw surfaces were left which it was impossible to close. Free drainage was provided and the patient put to bed in a fair condition though exhibiting some shock. He reacted nicely and on the second day had a spontaneous evacuation of the bowels. Five days after the operation a large amount of purulent discharge escaped from the wound on dressing. The sutures were removed, the wound opened down to the fascia and Carrel Dakin irrigation begun. On the 10th of September the wound was sterile and rapidly granulating, the edges were pulled together with adhesive strapping and he was discharged from the hospital on September 15 in excellent condition, pulse normal and appetite good. He was feeling better than for four months. It is of interest to note that during the week subsequent to his discharge he returned to the hospital with an acute obstruction of the bowel and was reoperated upon during the evening at which time I found a dense band of adhesions passing across the anastomosis and causing a complete obstruction. This was freed and the patient reacted nicely and has been in good health ever since.

The pathological report was that the gross specimen consisted of part of the ileum, the cecum and part of the ascending colon. The appendix was buried under thick fibrous tissue on the anterior wall of the ileum and sprang from the upper part of the cecum beside the ileocecal valve. The appendix was completely obliterated except for a small opening in the cecum. This was practically a diverticulum composed of mucous membrane only, the mucosa of the ileum and cecum was intact. The general appearance was not unlike



formation of scar tissue. The starting point of this proliferation seems to be as has been mentioned before in the submucosa whence it extends either inward to form circumscribed nodules or lengthwise causing diffuse infiltrations. The mucosa singularly enough is not involved unless through the secondary pressure of the contracting connective tissues causing pressure atrophy and localized coagulation necrosis of glands. Blood vessels are markedly congested partly because of the pressure upon their lumina

and partly because of permanent dilatation of the vessels due to atrophy of the adventitia and media of the smaller vessels.

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## CONGENITAL POLYCYSTIC KIDNEY

WITH A REPORT OF FOUR CASES OCCURRING IN CHILDREN OF THE SAME MOTHER

BY REINHARD F. WOBUS, M.D., F.A.C.S., ST. LOUIS, MISSOURI  
(PHOTOGRAPH BY U.S.A.)

THE pathology of polycystic kidney is not as yet quite clear. At various times different authors have held diverse views as to their cause, while at present it seems to be generally conceded that the cause or causes are not definitely known.

However, there have been three theories advanced which have had considerable support, and it is thought that one or more of these is responsible for the condition. The oldest of these known as Virchow's theory maintains that the cysts are caused by an inflammatory process which occludes the uriniferous tubules forming, as it were, retention cysts. This view was supported by Franchis, Rokitsanski, Roger, and Virchow. At present it does not seem to be very popular.

Chotinski, Hillipson, Nuwerck, Hufschmidt, von Kahliden, and others held that the cysts were a sort of adenocystoma, in other words, a distinct new formation. This theory is supported by analogy with cystic tumors elsewhere and by the histological structure of the cysts. It has many supporters today.

Hildebrandt, Harnu, Kibbert, Busse, and many later investigators take the cyst forma-

tion to be either an anomaly or an arrest in development. This seems to be the most widely accepted theory and is supported by the fact that other malformations frequently co-exist and by the not infrequent occurrence of several cases in members of the same family. The cysts are said to be formed by degeneration of remnants of the wolffian body or by failure of union between the excretory canals and the convoluted tubules. It has apparently been proven that these two structures are developed from separateanlagen. In the early embryo there are a renal vesicle and a primary collecting tubule, these uniting to form a single canal which later becomes convoluted. Should this union fail to take place, cysts will form from the renal vesicle.

Ziegler says the cysts sometimes consist of enlarged Bowman's capsules and concludes that they are a malformation rather than a degeneration. He holds that arrest in development as well as secondary processes, e.g., inflammation, may co-exist in the same case. Meyer supports the theory of malformation or lack of development and claims to have found a co-existing lack of development (atresia) of the ureter in most cases.



I th S l h l N t f k l d  
t l l k l l t l p j l b d m l ll  
b l t l l k

Braunwerth attempts to show that kidney cysts are quite common. He made a large series of autopsies on fetuses stillborn and very young infants and found that more than one half of them had actual kidney cyst. He is of the opinion that they are due to an arrest in development based on the theory of the dual development of the organ. He maintains that no line can be drawn between kidney cysts and cystic kidneys.

Virchow distinguishes between congenital cystic kidneys and the cystic kidneys of the adult. The view has been generally discarded. It seems that in individual with polycystic kidneys often survive until the kidneys are put under an extraordinary strain when he

U E N A B A B f h A B I  
S B I k l W h h

may succumb to uræmia. Hence many cases are discovered at autopsy after the patient has succumbed to an acute infection, the damaged kidney being unable to perform the extra work placed upon it. Our series seems to support the latter view as one of the living children without doubt has cystic kidneys while another would probably be alive but for an incident of childbirth.

All cases of congenital cystic kidneys seem to be accompanied by an ascites. In fact polycystic kidneys are usually listed in textbooks on obstetrics as a cause of fetal distress. Very little attention seems to have been paid to the cause of this accompanying condition. When we consider the extremely thickened parietal peritoneum in two of our cases we are compelled to regard the condition as one of chronic peritonitis rather than a mere transudation. This brings up the question whether the cystic kidneys in some way cause the peritoneal irritation or whether a common cause underlies both. As early as 1883 J. V. Simpson called attention to the fact that fetal syphilis may cause peritonitis. Ballantine<sup>3</sup> says that while ascites is frequently met with in syphilis there are numerous other causes. Unfortunately however he does not greatly enlighten us about them. He quotes Ohlshausen as reporting a fetus with malformation of the genito-urinary apparatus in which he thought the leakage of urine caused a peritonitis which was present.

Since syphilis does cause fetal peritonitis and has been suspected of causing certain malformations and since one of the fetuses showed a skin eruption, Wassermann was made of the mother's blood but proved negative. A search for pirochætte in the fetal liver was likewise futile.

In submitting the following case report it is regrettable that with the abundance of material we are unable to shed any new light on the cause of this condition. It is of interest because it shows that whatever may have been the cause of the polycystic kidneys as well as of the accompanying peritonitis (?) the cause became less potent with a surprising regularity in each successive

A I E h l l p 3

case. This regularity was not influenced by the fact that during the third pregnancy the mother was given antisyphilitic treatment. It will be seen from the following that this woman bore four children who undoubtedly had polycystic kidneys (Nos 1, 3 and 5). It is reasonable to suppose that No 4 has polycystic kidneys and also the fetus which was lost by abortion. The last child may even have a few cysts remaining making in all probability six if not seven cases of cystic kidneys.

The mother M. B. is a native of Bosnia a peasant who has enjoyed uninterrupted good health before during and since her pregnancies. At the time of her first conception she was twenty-four years of age.

May 8 1903 First delivery gestation supposed to have advanced seven and one half months but the child was under developed for that age. Parturition was impossible on account of the immensely distended abdomen which had to be evacuated to make delivery possible.

Male fetus (Fig. 1) had an abdomen filled with a clear yellowish fluid. The transverse diameter was the greater. The peritoneum was thickened especially that covering the parietes which was leathery and so tough that its rupture was almost impossible. There were some adhesions between viscera. The abdomen was divided into compartments by adhesions. The kidneys were of immense size completely joined at their lower pole.

January 30 1909 Well developed male child (Fig. 1). Abdomen had to be drained to permit delivery. There was a papular eruption on the face. The abdomen was large but not so large as No. 1. The parietal peritoneum was quite thick and dense but less so than in the first case. The visceral peritoneum was normal except that covering the kidneys. There were few adhesions. The kidneys were very large as seen in the illustration.

July 4 1910 Male child born at full term. Antisyphilitic treatment had been administered during the entire pregnancy. The abdomen was again too large to permit delivery but much smaller than in the case of the previous two. The kidneys were cystic and quite large. The peritoneum was



Fig. 2. Outline drawing of first child showing relative size of abdominal organs.

thickened on the abdominal wall but otherwise normal.

November 22 1911 Female child apparently healthy and normal. Delivery spontaneous. The child has weathered an attack of measles of whoop in cough and of bronchopneumonia. While not robust and somewhat small for its age it is today alive and well.

August 10 1911 Abortion at four months. Unfortunately the fetus had been destroyed before my arrival.

September 4 1914 Sixth pregnancy full term male child well formed with abdomen not enlarged. Delivery spontaneous but slow on account of face presentation. A midwife was in attendance and the child was stillborn probably due to tardy delivery as there was no apparent reason why the child should not be viable.

At autopsy nothing abnormal was found except polycystic kidneys the right weighing 40 gm the left 17 gm.

November 3 1915 Spontaneous delivery of full term male child which is alive and robust at the present time.



## ROENTGENOLOGIC ASPECTS OF HOUR-GLASS STOMACH

B. P. D. CARMAN, M.D., ROCHESTER, MINNESOTA  
F. M. H. Y. C.

THE increasing use of the roentgen rays in the diagnosis of gastric disease and the ease with which deformity of the gastric contour can be thus determined have resulted in a greatly increased number of correct diagnoses of hour glass stomach. But as might be expected it may also happen that after the roentgenologist has made a confident report stating that hour glass was present the operating surgeon will occasionally find that such is not the case and it is for this reason that after a few disappointments of this kind some surgeons have been inclined to question the value of roentgen findings in the diagnosis of this deformity.

In order to clear up misunderstandings in connection with the matter it seems timely to review the entire subject at some length. Even though facts are repeated that are well known to the initiated.

While hour glass deformity of the stomach is admittedly not a disease entity it possesses more or less distinctive pathologic importance and were there no other reason its striking title alone would give it a separate interest in medical literature.

Accurately speaking the hour glass stomach is simply an occasional end result of various gastric lesions but the nature of this end result materially affects the symptomatology, diagnosis and treatment of the causative disease. With the development of roentgen diagnostics the detection of this deformity has become far less difficult than formerly and the subject is therefore of particular moment to the roentgenologist.

The term hour glass defines itself and for the purposes of this paper we shall apply the term to every stomach with a locally constricted lumen anywhere between the pylorus and the cardia whether this is due to organic change or to spasm or both.

In the present study the intention is to deal with the subject chiefly from the roentgenologic standpoint which necessitates a

brief preliminary discussion of the etiology, pathology and clinical diagnosis.

As to etiology the time honored classification of hour glass stomach into congenital and acquired can hardly be discarded even though the existence of the former is doubted by some. Notwithstanding the cases reported and the supporting theoretical arguments offered congenital hour glass stomach is a rare condition and it is this extreme rarity that makes the subject of little practical interest especially to the roentgenologist who can hardly differentiate between these two types. For this reason too it will not be discussed further on the present occasion.

In a general way acquired hour glass stomach may be grouped into two classes: *organic* and *spasmodic*.

In the organic type the constriction is due to permanent structural changes either in or about the gastric wall. The stenosis thus produced is often increased by spasm of the circular muscle fibers but regardless of this fact the condition is essentially organic and stable.

Gastric ulcer either of the perforating or penetrating type stands first in the etiology. By perforating against an adjacent organ most often the pancreas or the liver the stomach is not only fixed at that point but the resulting adhesions may involve a considerable portion of the neighboring gastric periphery. Following this fixation and local transverse contraction the weight of the food probably tends to produce a sagging of the loculi exaggerating the proportional narrowing of the isthmus. When the ulcerative process without an immediate sealing off as sometimes occurs continues to excavate the tissues outside the stomach resulting in an accessory pocket it is frequently but not invariably associated with hour glass stomach. Penetrating ulcers may also give rise to hour glass constriction by infiltration and cicatricial contraction though less often than

the perforating variety. The ulcers giving rise to hour glass contraction are most commonly seated on the lesser curvature less frequently on the posterior wall and usually in either event in the middle third of the stomach. Generally the constriction occurs at the expense of the greater curvature which is drawn sharply toward the lesser curvature while the latter holds its usual position. The indentation of the greater curvature is as a rule relatively narrow resulting in a correspondingly short isthmus along the lesser curvature which gives the deformed stomach a resemblance to the capital letter B.

There are occasional striking exceptions. An ulcer on the greater curvature may be accompanied by an indrawing of the lesser curvature an ulcer in any situation may contract the walls of the stomach in the plane of its site the isthmus instead of being short may be relatively long. The width of the canal is of course variable but even when it is quite narrow the constriction is nearly always sufficiently emphatic to be readily noted.

Gastric syphilis which is more often recognized now than in the past probably ranks second to simple ulcer in producing hour glass stomach.

Gastric cancer as a causative factor in hour glass stomach probably ranks next in importance but this has been found to be an accompaniment in less than 1 per cent of the cases. The cancer may be of the annular type encircling and constricting the gastric circumference or if localized at either curvature at the anterior or posterior wall it may produce contraction of that segment of the stomach. Again a cancer mass projecting into the lumen of the stomach may divide it into two chambers. Sarcomata or benign growths may cause a similar biloculation but such tumors are not of common occurrence.

A hyperplastic form of tuberculousis is occasionally met with in the stomach the process involving the pyloric end of the stomach without hour glass deformity. However tuberculous ulcers which are often multiple and seated in the midstomach may constrict this portion (Fig. 1).

More or less contraction may ensue follow-

ing certain operations notably gastrostomy gastro enterostomy sleeve resection or local excision of gastric lesions (Fig. 2). After gastrostomy or sleeve resection the contraction may be fairly pronounced but after gastro enterostomy there is usually no constriction unless a gastrojejunal ulcer develops or extensive adhesions form (Figs. 3 and 4).

Hour glass contraction has resulted from scarring due to corrosive chemicals such as murtic acid as in a case reported by Klein (11).

Perigastric inflammatory processes of various kinds may produce bands or adhesions and cause hour glass deformity. Occasionally cases of hour glass are found to be caused by a single adhesion band of unknown origin (Fig. 3). In Elder's (4) case the stomach was drawn up by a ligamentous band from the right rectus muscle. Mayo Robson (13) mentions an instance in which the stomach was trilobular one constriction (the proximal) being caused by a band of adhesions from the liver to the transverse colon while the other stenosis was due to the cicatrization of a chronic ulcer.

Conflicting statements have been made as to the relative size of the two pockets in organic hour glass particularly the common form due to ulcer. Tuffier and Roux Berger (5) generally found the narrowing to be nearer the pylorus than the cardia hence the upper pouch was the larger. On the other hand Lusterman (6) found the lower loculus to be the larger in a considerable series of cases. Roentgen examination of the cases in the Mayo Clinic for five years past would indicate that in the majority of instances the upper pocket was the larger but this discordance in observations is rather immaterial. Moynihan (14) has found that the proximal portion has thicker walls than the pyloric portion and is larger by reason of dilatation and hypertrophy.

Among the complications of organic hour glass volvulus has been observed by Hermes (9) and Reinecke (16). In Hermes case the hour glass constriction was the size of a finger. The pyloric loculus had rotated on its long axis protruding through a slit in the

mesocolon. In Reinecke's case also there was a volvulus of the pyloric segment causing complete stenosis at the hour glass constriction.

Referring to *spasmodic* hour glass stomach the role played by spasm in the production of this condition has become better understood with the increasing employment of the roentgen examination. Surgeons have some time noted peculiar spastic manifestations in the stomach during operation. For example W. J. Mayo while operating has on several occasions seen such spasms in which the stomach slowly contracted the gastric wall became thick and blanched and then is slowly relaxed again. But the significance of this spasm was not appreciated until the roentgen ray and the opaque meal came into common use. One of the earliest discoveries was the fact that the barium filled stomach sometimes showed a spasm of the circular muscle fibers in the plane of a gastric ulcer thus producing an indentation on the opposite curvature, the incisura. Later more diffuse forms of spasm were recognized and the whole subject of gastrospasm became an important chapter in gastric enterology.

The particular form of spasm producing hour glass stomach may be classified as *intrinsic* and *extrinsic*.

*Intrinsic* spasm is a convenient designation for spastic contraction of the gastric musculature arising directly from a lesion of the stomach itself. In the majority of cases the lesion is an ulcer and most often the circular fibers chiefly are affected (Fig. 6). When the stomach is filled with barium the spasm is roentgenologically observed opposite the ulcer as a local indrawing of the curvature commonly the greater. It is in this form that the indentation may be relatively slight in some cases or so deep in others as almost to bisect the stomach. Cancer may also produce a similar local spastic indrawing of the gastric wall (Fig. 7) and spasm is probably accountable in some case for the hour glass contraction accompanying tuberculous and syphilitic lesions.

The view has been expressed by Moynihan (14) and by Feizenstein and Frei (17) that in many cases of organic hour glass stomach

the narrowing is exaggerated by spasm. This is unquestionably true.

*Extrinsic* spasm is either produced by lesions outside the stomach or is at all events accompanied by such lesions. It is an occasional cause of hour glass deformity as seen roentgenologically and has been frequently noted in association with duodenal ulcer disease of the gall bladder or appendix and sometimes in hysterical or other nervous states.

The purely spastic hour glass deformity, whether of intrinsic or extrinsic origin is rarely present at operation because of the relaxation produced by the anesthesia and for this reason the roentgenologist is some time wrongfully accused of a *maldia no is*.

As to symptoms and signs the clinical literature of hour glass stomach is most exclusively devoted to the organic form. Agreement is general that the symptoms alone are not diagnostic. They may point rather definitely to ulcer the most common causative lesion but seldom suggest the complicating factor. In a few of the cases reported as congenital it is noteworthy that the patients though adults gave only a recent history of gastric disturbance.

On the other hand the physical signs of the condition have been given considerable stress. Moynihan (14) holds that the diagnosis in conjunction with the symptoms enables a positive diagnosis to be made in the great majority of cases. Mayo Robson (13) says:

While in nearly all cases the cause has been capable of diagnosis the effect has also been diagnosed in some and may be in nearly all cases if care and time be given the diagnosis.

Tuffier (20) states that the importance of the clinical signs has diminished with the use of the roentgen ray. However he sounds a warning to the effect that in spite of its precision a roentgenologic examination for hour glass stomach may lead to error.

Moynihan's compilation of the physical signs as quoted by Osler (15) includes the following:

1. A measured quantity of water is put into the stomach through the tube. The water is immediately withdrawn but a portion fails to return having been lost as through a hole. (Woelfler's first sign.)

2 The stomach is washed out until the fluid returns clear. There may then be a sudden rush of foul smelling liquid regurgitated from the lower pouch. (Woelfler's second sign.)

3 The stomach is filled with fluid and succussion sounds are elicited. After withdrawing the fluid as completely as possible succussion sounds may still be noted because of liquid still remaining in the lower loculus. (Jaworski's paradoxical dilatation.)

4 Von Eiselsberg observed in one of his cases that on distending the stomach a bulging of the left side of the epigastrium was produced. After a few moments this gradually subsided and at the same time there was a gradual filling up and bulging of the right side.

5 Von Eiselsberg has also noted a hissing sound in the region of the constriction while distending it with  $\text{CO}_2$  by administering separately the two component parts of a Seidlitz powder. The noise is heard by applying a stethoscope two or three inches to the left of the midline.

6 By using a Seidlitz powder in the same way Moynihan has noted after 20 or 30 seconds an enormous increase in resonance of the upper stomach. Later the pyloric pouch may fill and become prominent.

7 Schmidt Monard Lichhorst and Moynihan have all seen cases which showed a distinct sulcus between the two pouches after distention with  $\text{CO}_2$ .

8 By filling the stomach with water and employing gastroduaphany Ewald (6) has observed that the transillumination is seen only in the cardiac pouch lying to the left of the midline while the pyloric pouch remains dark. He has also used the deglutible rubber bag of Hemmeter (8) and Turck (21) in a similar way. Distending the bag causes a bulging of the cardiac pouch only.

While some of these signs carry more or less conviction there are some which seem almost trivial. Notwithstanding the opinion of Mayo Robson and Moynihan that a positive diagnosis is possible in most cases it is noteworthy that neither they nor others report many cases as having been diagnosed clinically before operation while it is obvious

that the roentgen ray affords a practical and efficient means of diagnosis.

#### ROENTGEN DIAGNOSIS

Since the essential feature of an hour glass stomach is its biloculation by an intermediate constriction it would seem that the choice of roentgenologic methods to demonstrate this fact is not important. It is conceivable that the roentgen examination might show the biloculation after air inflation more or less positively. However by filling the stomach with an opaque meal the deformity of the gastric outline is shown more definitely and this method is almost universal (Fig. 8).

The screen examination is made with the patient standing and if necessary in the recumbent position also. Plates may be made with the patient in either position but in hour glass stomach the vertical is preferable.

Hour glass deformity is so striking in the roentgen shadow of the barium filled stomach that save in exceptional instances it can readily be recognized even by the novice. But as Groedel (7) well says the diagnostic task has only begun with the establishment of the presence of an hour glass form for the roentgenologist should endeavor to distinguish between the following varieties: (1) organic (2) spasmodic from an intrinsic lesion (3) spasmodic from lesions or conditions outside the stomach (4) pseudo hour glass.

In conformity with its pathologic anatomy the organic hour glass resulting from gastric ulcer usually shows a B form (Fig. 9) in the roentgen image the constriction being at the expense of the greater curvature which is drawn toward the lesser. Almost invariably the cleft is deep and relatively narrow so that the loculi communicate by a short canal of small caliber. Indeed the canal may be so stenotic that a portion of the six hour meal is retained in the upper loculus but this is exceptional. However with a very narrow channel the stenosis may be evident by retarded passage of the barium water or barium pap during the screen examination even if there is no retention from the six hour meal and in many cases it trickles very slowly through the aperture running in a curvilinear course along the lesser curvature.

With these conditions present the observer can feel considerable certainty that the hour glass is really organic. Com and Delaforge ( ) have called attention to another item of some diagnostic significance the sagging of the upper loculus (Fig 10) They describe the lower border as curved and encroaching upon the cleft or else completely overhanging it so that palpatory pressure may be necessary to demonstrate the constriction between the loculi. Often a niche or recessory pocket is seen on the lesser curvature side of the isthmus associated with hour glass and this favors the probability that the hour glass is organic although it is not conclusive proof. Fixation of the stomach is evidenced by its resistance to efforts at palpatory shifting and suggests that the deformity is organic. An important feature is the fact that neither the position nor the contour of the constriction can be altered by manipulative means.

Carcinomatous organic hour glass is easily recognized as a rule. The isthmus may be centrally placed often with a tunnel like expansion at either end so that it has the form of a script X (Fig 11) The contour of the canal is usually irregular due to small projections from the tumor mass and the diminished width of the growth itself may be visible. In addition a tumor corresponding to the filling defect can be felt the evidence is reasonably complete. However all the cases do not possess the typical characteristics the growth may involve only one curvature and in such instances the channel between the loculi lies along the opposite curvature. In many of the cases the condition is strictly peaking an hour glass form of the gastric lumen rather than of the stomach as a whole the local narrowing of the cavity being caused by the projection of the tumor into the lumen and judging by the external contour of the stomach is seen at operation the surgeon would hardly consider it a true hour glass. Medullary cancer especially may produce an hour glass of this sort.

The scirrhus type infiltrating the gastric wall is more likely to result in actual contraction. It is interesting to note that the carcinomatous hour glass seldom causes a

six hour retention in the upper loculus even though the isthmus is quite narrow.

Syphilitic hour glass may result either from luetic ulceration or hyperplasia. The hyperplastic or gummatous type with filling defects and a corresponding palpable mass is not roentgenologically distinguishable from cancer. Syphilitic ulcers are often multiple and their strong tendency to the production of hour glass has been frequently noted (Fig 12) Dew (3) believes that he has noted a characteristic point which differentiates it from cancer and simple ulcer. In syphilitic hour glass of the stomach we see a long regular isthmus at each end of which the wall of the stomach rises more or less abruptly or dumb bell like. This is in contrast to the sharp incision of simple ulcer hour glass with practically no isthmus and the picture differs quite as much from the cancer hour glass with the infiltrated wall of the stomach sloping irregularly away from the constricted portion (Fig 13) This dumb bell appearance has also been described by LeWald (1) We have occasionally observed the appearance which Dew and LeWald describe and sometime fancied that the shadow of the bromium filled luetic stomach showed a peculiar fitness as compared with the roentgenograms of other lesions. As a matter of fact however the roentgenologist's first suspicion of the lesion being syphilis rather than cancer is usually aroused not by the roentgen picture so much as by certain obvious clinical facts. There is the absence of a palpable mass the patient may be under the cancer age he is anemic rather than cachectic and has not lost weight and strength in proportion to the extent of gastric involvement and the duration of his trouble. Then with a positive Wassermann the diagnosis of lues is warranted but hardly otherwise.

All forms of organic hour glass stomach have certain features in common they are persistent at successive examinations constant in situation cannot be effaced by epigastric massage and remain unaltered after the patient has been given atropine or belladonna to physiologic effect.

Purely spastic forms of hour glass produced

directly by gastric lesions and hence conveniently designated as intrinsic are seen in association with ulcer and cancer. As stated before the spastic hour glass of ulcer like the organic form is seen opposite the ulcer in the shape of an indentation of the curvature usually the greater (Fig 14). The depth of the indentation varies but is nearly always greater than its width. Occasionally when the indrawing is not very pronounced it may appear as a triangular notch. Each of two or more ulcers may produce an incisure either separately or if the ulcers are closely adjacent fused irregularly together so that the margins are not clean cut. As a rule the single deep spastic incisure is regular in outline with straight parallel sides and thus appearance is of some value in distinguishing it from an organic constriction. However such characteristics have also been observed in organic hour glass stomach (Figs 8 and 9). In other respects it does not differ from the organic variety is constant in situation present at a second examination can not be obliterated by palpatory maneuvers and is still present after the administration of antispasmodics.

Spastic contraction is associated with gastric cancer less frequently than with gastric ulcer. Usually it is seen as an indrawing of the greater curvature opposite the growth and is considerably wider than the contraction produced by an ulcer. Holzknecht has spoken of it as the broad incisura of cancer (Fig 15). The luminal margin of the contraction is often irregular. Rarely a small cancer may provoke a narrow spastic contraction resembling that of ulcer. The broad spasmotic contraction may be mistaken for a filling defect produced by the growth itself but close inspection of the plate will show that the indentation is clearly outlined without any faint shadow of a tumor mass between the borders although a shaded filling defect corresponding to a palpable mass may be seen directly opposite the contraction. The whole picture is as a rule so plainly indicative of cancer that the examiner will have little interest in the question whether the hour glass is organic or spasmotic or both. That spasm probably accentuates the

various forms of organic hour glass deformity is supported by the fact that the isthmus depicted by the roentgen ray is often much narrower than when exposed to view at operation.

Spasmotic hour glass contraction resulting from or at all events associated with conditions outside the stomach is one of the most deceptive manifestations with which the roentgenologist has to deal (Fig 16). Although a definite etiologic relationship is difficult to establish there are three conditions which are especially prone to be accompanied by some form of gastrosphincterism: chronic cholecystitis, chronic appendicitis and duodenal ulcer. Gastric spasm is not infrequently seen in morphinism, plumbism, general nervous states or in timid patients who are frightened by the process of examination. With some of these spastic phenomena such as total gastrosphincterism for example in which the entire stomach is irregularly contracted we are not here concerned. Local or regional extrinsic spasms producing hour glass deformity are most frequently seen as a cleft of the greater curvature resembling the incisura of a gastric ulcer. With one exception spastic hour glass from extrinsic causes can usually be differentiated from other forms of hour glass. Extrinsic spasm may alter in intensity and thus change in appearance during the examination it can sometimes be erased by steady forceful though not violent epigastric massage it is often absent at a second examination it disappears after giving belladonna (Fig 17).

The one exception to these eliminative tests is gastric spasm arising from duodenal ulcer. The spasm ranges from a moderate incisure to a pronounced contraction and tends to persist even after full doses of belladonna have been given so that the observer is inclined to accredit it to a gastric lesion (Fig 18). The puzzle is further complicated by the fact that a duodenal ulcer and a gastric ulcer may occur in the same case. In every instance of suspected spastic hour glass it behooves the examiner to confirm or exclude the presence of duodenal ulcer. If an ulcer is present as shown by constant distortion of

the duodenal bulb the presumption is strong that it is the cause of the gastrosplasm although careful search should be made for the niche of a gastric ulcer. If no duodenal ulcer is found and the gastrosplasm withstands all eliminative tests the spastic condition is probably of intrinsic origin thus indicating a lesion within the stomach even though it cannot be seen (Fig. 19).

In administering belladonna to relieve gastrosplasm it is emphatically necessary that the amount given is sufficient to produce the usual physiologic effect of dryness of the throat, pupillary dilatation, etc. Our own custom is to prescribe the tincture starting with twenty drops and repeating the dose frequently until the desired effect is obtained. Since some patients have an idiosyncrasy for the drug it is advisable to keep them under close observation and stop its administration if untoward symptoms develop.

Atropine sulphate injected hypodermatically in single doses of 100 to 150 (1/50) of a grain is preferred by some examiners. It has the advantage of permitting a second examination soon after the first probably before the stomach is empty. We have not adopted this practice because it is impossible to determine the necessary dose to produce a physiologic effect and patients usually object to repeated hypodermic injection. On the other hand belladonna can be given by mouth without any objection from the patients and so far as our experience goes the results are all that could be desired.

Conflicting opinion as to the effectiveness of belladonna in relieving gastrosplasm are probably due to the various form, method and doses in which it is given. Thus Reizenstein and Frei (17) state. We must reject the accepted teaching that atropine will differentiate the spastic from the organic forms. We could never convince ourselves of a positive effect of atropine in the case of relaxing spasm but on the contrary have observed an increase of it by this means. Barclay (18) says that belladonna relieves some spasmodic hour glass stomachs while it may have no effect on others that are susceptible to the effects of massage and thus prove themselves to be spasmodic. He also cites a case

in which the stomach was relaxed by belladonna and yet a healed ulcer was found at operation. Ickler (18) who uses the extract of belladonna states that only a positive result is of value. Strauss (19) has found both atropine and papaverine very unreliable in his experience. Notwithstanding the testimony of these observers our own cases of extrinsic hour glass stomach (barring those produced by duodenal ulcer) which failed to relax after belladonna were only those in which an insufficient amount of the drug had been given and our own confidence in this treatment remains unshaken.

It is true that belladonna or atropine will not differentiate between spasmodic and organic form of hour glass stomachs but they will differentiate between the intrinsic and extrinsic forms. When the hour glass contraction is the only roentgen sign present this test must be very carefully carried out as otherwise the roentgenologist may lead the surgeon into error. It has been our experience that any hour glass that resists belladonna to the physiologic effect means a lesion either of the stomach or duodenum and regardless of whether the hour glass is present or not at operation the surgeon will find the cause if he looks for it.

Paralysis of healed ulcer with relaxation of the hour glass after belladonna is extremely interesting. We have never observed such a case. Neither have we found massage to have any effect on intrinsic gastrosplasm. At the same time the obvious fact should never be overlooked that all spasmodic form of hour glass stomach are relaxed by the anticholinergics.

Aside from the hour glass deformities of the stomach due to actual contraction of the gastric wall whether organic or plastic there are pseudo hour glass forms, i.e. certain semblances of the hour glass form as seen roentgenologically which may be more or less deceptive to the untrained observer.

One of these is the elongated hypotonic or so called atonic stomach. Hertz (20) dignifies it by the term orthostatic hour glass stomach. By reason of its tonusless walls the stomach is lengthened and its capacity increased. Ingesta which would fill



Fig 1

Fig 1 (5298) Organo hour glass stomach in a case of gastric tuberculosis. Post mortem confirmation.



Fig 2

Fig 2 (9830) Spasmotic hour glass stomach after gastrostomy done 18 years ago in a case of cardiac



Fig 3

Fig 3 (94543) Spasmotic hour glass constriction following ulcer resection for multiple gastric ulcers. Contracture at point of anastomosis.

a stomach of average size accumulate in the expanded basin like lower pole and with the patient standing the dragging weight of the gastric contents causes a spindle like approximation of the walls in the middle third. The ingesta can be forced upward by manual pressure so as to dilate the apparent narrowing and thus prove its deception.

Somewhat similar in appearance and perhaps related to the above is the so called corset stomach seen in enteroptotic women who are given to tight lacing. However Groedel believes that the corset stomach be-

longs to the scar hour glass type and says:

It is anatomically confirmed that foolish tight lacing may give rise to a thickening of the serosa which shows the characteristics of a scar hour glass. Rieder (18) also lists it as a possibility among the acquired forms but considers it doubtful and very improbable that tight lacing would cause a permanent hour glass.

A third simulant of hour glass is that produced by the imprint of a tumor outside the stomach. The indented portion of the gastric wall is usually a wide smooth incurva-



Fig 4

Fig 4 (191809) Spasmotic hour glass constriction following ulcer resection. The narrowing is at the point of anastomosis.



Fig 5

Fig 5 (1280) Hour glass stomach due to adhesions in a case of cholelithiasis and chronic appendicitis. Stom-



Fig 6

ach and duodenum negative. Roentgenogram made after deep inspiration.

Fig 6 (1908) Intrascle hour glass stomach. Case of gastric cancer without crateriformity. Contracture appears much deeper in roentgenogram than it did at operation.





Fig 7



Fig 8



Fig 9

Fig 7  
h 4 i tr i m d h gl t m  
h ll Rh d i m ty t ff t d f ball d t m h  
t t f d f t t th t m l j l

Fig 8  
h 8 c 43 (t i f t g g t l p d h  
h j gl t m h  
l j ( 7 5 t Org h gl t m h  
f h l f Rh d f m ty g th t m h the  
f j t l l B

tion which have appearance on manipulation of the stomach.

Other causes of pseudo hourglass stomach are for example strong retraction of the abdominal wall and the dorsal and prone position of the patient (Fig 6). Most of these simulants can be easily eliminated by a little manual palpation behind the crura especially while in the vertical position (Fig 21).

Practically then unless the case is extraordinarily typical it is only by a process of elimination that the several varieties of hour

glass stomach can be differentiated. First the mere pseudo hourglass must be excluded and this is seldom difficult next extrinsic spasm from most causes can be eliminated by the various procedures mentioned particularly the belladonna test. If the hourglass persists after this test the examiner may reasonably assume that the deformity is either (1) organic of itself (2) that it is an intrinsic spasm arising directly from an intrinsic lesion or that it is (3) an extrinsic spasm due probably to duodenal ulcer.



Fig 10



Fig 11



Fig 12



Fig 13



Fig 14



Fig 15

Fig 13 (804) High hour glass stomach with dilatation of the oesophagus in a case of gastric lues Wassermann positive

In spite of treatment (5F) and antulietic treatment the constriction became more marked. The patient lost weight rapidly from 113 to 90 pounds. Fluids were taken with great difficulty and operation was thought advisable.

Findings at operation. Stomach about 10 centimeters long and from 6 to 7 centimeters in diameter. For a distance of 4 centimeters extending from the pylorus up to

the constriction the stomach was contracted to about 1 centimeter in diameter.

Operation. Sleeve resection with removal of two thirds of the stomach. Jejunostomy.

Fig 14 (14038) Perforating gastric ulcer. Spasmodic hour glass stomach. Not affected by belladonna because intrinsic in cause and not present at operation because relaxed by the narcosis.

Fig 15 (140035) Intrinsic spasm of hour glass stomach. Malignant ulcer of the posterior wall of the stomach.

A careful screen and plate examination of the duodenal bulb will either confirm or exclude the presence of an ulcer. If no duodenal ulcer is present the presumption is strong that the constriction of the stomach is due to a gastric lesion with the chances favoring ulcer or its scar even though the niche of the ulcer cannot be seen. If a

duodenal ulcer is found it may be inferred that the hour glass is a spastic reflex from the ulcer although this inference is not absolutely safe since about 11.5 per cent of duodenal ulcers occur in association with gastric ulcer. When the field has been logically narrowed to a choice between an hour glass deformity which is organic of itself and one which is



Fig 16



Fig 17

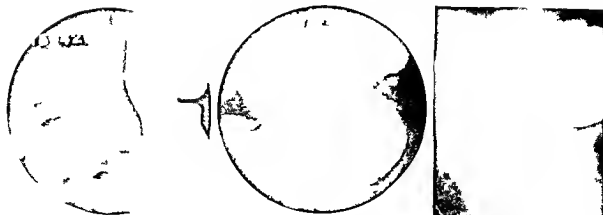


Fig 18

Fig 16 (0594) Intrinsic hour glass stomach which relaxed after belladonna to physiologic effect. Note Fig 7.

Fig 17 (0594) Same case as Fig 16. Stomach normal in outline after giving belladonna to the physiologic effect.

Fig 18 (10077) Spasmodic hour glass stomach in case of duodenal ulcer. The hour glass persisted at operation because it was relaxed by the narcosis. The same result was related by anti-motile in one experiment.



I 9 I 10 I 11 I 12 I 13 I 14 I 15 I 16 I 17 I 18 I 19 I 20 I 21 I 22 I 23 I 24 I 25 I 26 I 27 I 28 I 29 I 30 I 31 I 32 I 33 I 34 I 35 I 36 I 37 I 38 I 39 I 40 I 41 I 42 I 43 I 44 I 45 I 46 I 47 I 48 I 49 I 50 I 51 I 52 I 53 I 54 I 55 I 56 I 57 I 58 I 59 I 60 I 61 I 62 I 63 I 64 I 65 I 66 I 67 I 68 I 69 I 70 I 71 I 72 I 73 I 74 I 75 I 76 I 77 I 78 I 79 I 80 I 81 I 82 I 83 I 84 I 85 I 86 I 87 I 88 I 89 I 90 I 91 I 92 I 93 I 94 I 95 I 96 I 97 I 98 I 99 I 100

spastic but arising from a gastric lesion the examiner is apt to concern himself more with the nature of the cause than the manner in which the hourglass effect is produced. In other words he is more interested and properly so in deciding between ulcer, cancer and syphilis than in determining whether the hourglass is due to intrinsic spasm or to permanent contraction. If the upper loculus shows a retention from the six hour meal or if the upper loculus sag to the left and below the cleft or if there are irregular filling defects about the isthmus typical of cancer the examiner may be quite confident that the constriction is at least partly organic and will be found by the surgeon. But if with a tight hourglass constriction there is neither a retention from the six hour meal nor a retarded flow of the barium suspension, if no niche accessory pocket or filling defect is visible and the indentation has a straight parallel border the constriction is probably spastic and will not be seen by the surgeon at operation.

#### CONCLUSIONS

1. Hourglass stomach should not be considered a disease entity but an end result of various pathologic processes gastric and perigastric.

The possibility of congenital hourglass stomach must be admitted although most cases reported have been questioned.

2. The roentgenogram usually shows a much deeper constriction than is seen at operation due to the fact that the organic narrowing is exaggerated by the spasm.

3. Cases of paucimodular hourglass whether intrinsic or extrinsic in cause are not seen by the surgeon because they are relaxed by the narcosis. Therefore if the hourglass is the only roentgen sign present the first thing to do is to exclude extrinsic causes.

4. Belladonna or atropine does not differentiate between the organic and intrinsic types of paucimodular hourglass stomach.

5. Belladonna or atropine to physiologic effect will differentiate between the intrinsic and extrinsic types of paucimodular hourglass stomach.

6. Operation have proved the organic type the most common. However the paucimodular when intrinsic in origin is just as important from a diagnostic standpoint as the organic.

7. The varieties of hourglass stomach therefore admit of the following subdivision:

- A. Congenital
- B. Acquired

1. Organic constriction due to structural changes in or about the stomach. Causes: ulcer, scar of healed ulcer, perigastric adhesions, cancer, syphilis, corrosive, resection, gastrotomy, congenital (?).

Spasmodic (or functional) cramp of the gastric muscle without structural change. Two types (a) intrinsic cramp directly produced by lesions in the stomach causes practically the same as those of organic hour glass (b) extrinsic cramp indirectly produced by causes outside the stomach duodenal ulcer diseases of the gall bladder disease of the appendix neuroses tribes lead intoication morphine nicotine

C Pseudo hour glass simulating the hour glass form without either spasm or structural change in the stomach. Causes contraction of abdominal muscles pressure of stomach against the spine tumors outside the stomach atonic stomach gas and fecal matter in the bowel

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front and behind to the level of the clavicles. The systolic pressure at this time had dropped to 160. The basilic vein was opened in an attempt to bleed her but only a small amount of thick, almost black blood could be obtained. She was given oxygen subcutaneously and was stimulated in every way possible but died in an hour without having had a convulsion and remaining semiconscious to the end. No autopsy could be obtained.

CASE 2 Patient of Doctor McIlwraith Mrs. P. age 35 II para. The first pregnancy had ended in an early abortion. There was no history of previous illness except that she had had some attacks of faintness year before which had been attributed to heart disease. Careful examination however revealed no demonstrable lesion. The last menstruation had occurred on March 13, 1916. The patient lived in another city and a month before coming to Toronto had sent a sample of urine which was examined and found to be normal. She omitted to send a sample two weeks later and during this time did not feel in her usual good health. She came to Toronto on November 19, 1916 and was then found to have a systolic blood pressure of 210 and a slight amount of oedema of the feet. She was sent to the hospital at once. The urine had a specific gravity of 1010, was acid in reaction and contained a considerable amount of albumin with granular casts and large numbers of bacilli. She was put to bed and given magnesium sulphate and 15 minims of veritrene. At 3:30 that afternoon her temperature was 99.3 and her pulse 104. At 7:30 p.m. the patient was sitting up in bed feeling perfectly well and chatting with her husband but fifteen minutes later was seized with sudden coughing dyspnoea and choking. When McIlwraith arrived fifteen minutes later her distress was extreme. Large bubbling rale could be heard on both sides of the chest and though quite conscious and rational the patient was very cyanotic. A venesection was done and 16 ounces of free flowing blood removed after which she was given one quarter grain of morphia and five grains of camphor in oil. At eleven p.m. it was proposed to do a caesarean section but a skilled anaesthetist refused to give the patient an anaesthetic. Therefore the membranes were ruptured and one eighth grain of morphia given after which she was allowed to breathe oxygen. Her condition improved at once and though she vomited large quantities of clear fluid during the night she suffered little

distress. By the following noon however she was again suffering from extreme dyspnoea with blood stained frothy mucus running from her nose and mouth. At 3:30 p.m. a caesarean section was done under gas and oxygen and local anaesthesia. She was delivered of a living child but her condition did not improve and she died at 2 a.m. Nov. 24, 1916.

We have here then two cases of acute pulmonary oedema occurring during pregnancy, one at six months and the other at eight months. In both cases the outstanding feature was a tremendously high blood pressure. In the first case apart from the urinary findings there was very little else to be discovered before the onset of the acute symptoms. The second case it is true had a considerable amount of oedema elsewhere in the body but in the first case this oedema was confined to the lungs. In neither case so far as could be discovered was there any pre-existing cardiac lesion. These cases can hardly be classed as eclamptic because they had no convulsions (which we consider essential for eclampsia) nor did they die in coma without convulsions which of course by some observers is enough to classify a case as eclamptic. We interpret the condition as being due to a profound toxæmia giving rise to a high blood pressure which finds its outlet in a spot of weakened resistance in the lung. These cases have strengthened a conviction which we have held for some time, namely that blood pressure findings are the best indications that we have regarding the severity of a given case of pre-eclamptic toxæmia. Moreover in dealing with albuminuria and high blood pressure during pregnancy one should have in mind not only the possibility of a development of convulsions but also that at any time a complication far more tragic than the ordinary eclampsia may arise.

# DEPARTMENT OF TECHNIQUE

## TEMPORARY INTERNAL FIXATION OF COMPOUND FRACTURES

B W L BROWN MD FACS AND C I BROWN MD ELI TEXAS

As our work has increased in the last few years we have come to realize more and more the importance of making the improvement in the usual method of immobilizing compound fractures. As we have occasion to operate more often on ununited fractures with deformity, arthritis and fragmentation the more firm has become our belief that it is better and much easier to prevent the deformity than to correct them after they have occurred. It is not unusual to find one of the ulnar and radial heads ununited in bad position with considerable functional impairment where at operation it is almost impossible to correct the deformity without taking the risk of infection and bone transplantation.

From experimental and all a clinical work we now know that the first effort nature makes in the repair of a fracture is always the greatest. Consequently it is essential to give her every aid during the first effort in the aid of a union that it will be an easy matter to correct a deformity of a transplant and get a good functional result at a secondary operation. The more experience we have in fractures especially in the treatment of the Army and frequent operation the less confidence we have in our ability to reduce fracture and maintain them in reduction by external manipulation and external plating.

The general trend in the treatment of compound fractures during the present war is toward much more radical means than formerly practiced. This is only in keeping with sound surgical principle. While we do not advocate operation upon every compound long diaphyseal fracture until we have never had occasion to resort to it. We have done so. Our attitude toward so-called conservative treatment or non-treatment of compound fractures except infection of the kind is very much like our attitude toward varicella after a diagnosis of appendicitis or not giving antitoxin after a diagnosis of diphtheria because we can point to a certain percentage of cases even go per cent that have recovered without operation or antitoxin.

We think there has been no more pernicious teaching than that of so-called conservative treatment until infection is well established. This has been recommended in some very recent article on fractures by surgeon otherwise considered good authorities.

In the treatment of gunshot fracture the of the most experience in the present war quite uniformly agree that immediate operative interference with removal of foreign bodies cutting away of devitalized tissue establishing free drainage thoroughly cleaning with some antiseptic and a complete immobilization as possible are the important indications. Some are now beginning to think that complete mechanical cleaning cutting away of devitalized tissue drainage and external immobilization as complete as possible are probably sufficient without the use of antiseptic. There is being more and more stress laid upon the mechanical cleaning and immobilization than any other two features of the treatment.

Our experience for the past two years has added what we believe to be something as important as either of the above two or possibly more important and that is temporary fixation of the fracture preferably with the Parham Martin band or if not feasible with a Lane plate. This fixation to be removed under local anesthetic as a rule at the end of five or six weeks. In case of compound fractures where interference is otherwise indicated for the control of hemorrhage removal of foreign bodies or infection or coaptation of fragments we have found nothing to contra-indicate the use of internal fixation with the expedient of removing it as soon as there has been sufficient callus and fibrous tissue formed to hold the fragments in apposition. We are unable to see any comparison between this method

here the above procedure are otherwise found necessary and that of transfixation by method where screws or pins are driven into bones for the purpose of making tension. The internal fixation frequently reduces or solves the problem of extension.



Fig. 1 (at left) Belt wheel compound fracture of leg with extensive laceration of tibia. Immediate plating and Dakin's solution. Plate removed six weeks. Firm union in three months.

Fig. 2 Same as Fig. 1, three months following injury. Alignment perfect with large bony calluses both bones.

It was the teaching of the late John B. Murphy never to bury any foreign substance at the primary dressing of compound fractures because they never healed while a foreign body was present. While this teaching we believe was correct still Murphy had in mind the question of buried material being left permanently and we never heard anything in his teachings or read anything in his writings where he approached the question from any other standpoint. It is also agreed by those most experienced in the present war that the extension of infection in compound fractures bears quite a definite ratio to the degree of immobilization.

After all of the above procedure have been carried out we consider next of importance the proper placing of drainage tube as advocated by the followers of the Carrel-Dakin method of wound disinfection and just as close attention should be paid to these details in the cases that have internal fixation as in other cases. That the application of the Carrel-Dakin method has been misapplied and misunderstood from a mechanical standpoint is frequently as from the improper preparation of the solution we are quite well convinced. We have repeatedly seen it applied in a way that it was simply traversing

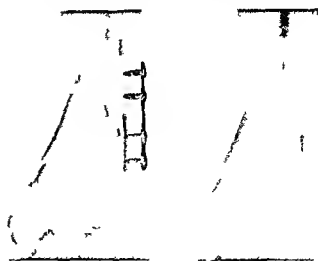


Fig. 3 (at left) Three months after operation car wheel injury extensive destruction of soft parts and tibia. Two fractures of tibia. Too much destruction of tibia to allow plating. Immediate fixation by Dakin's solution at primary dressing. Small sinus at eight weeks when plate was removed.

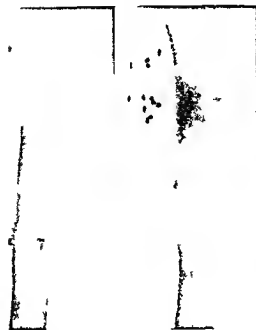
Fig. 4 Three months and four days following operation all wound healed firm union in both bones. Leg perfectly straight good motion ankle joint. Able to resume work at the end of five months.

a through and through drainage tube and not in any way coming in contact with the deeper parts of the wound.

It may be argued that in introducing a metallic foreign body into a compound fracture we are putting in the exact thing which we have set out to remove. While it may so appear this is not true because the original foreign body is probably infected it goes into the soft tissues and is a focus of danger and is often buried deeply where there is improper drainage. On the other hand the internal fixation foreign body has none of the above objectionable features and is always at a point where drainage is best and antiseptic are present.

One of the immediate effects noticed following internal fixation of the fragments is the relief from pain. This and the convenience of handling the limb for frequent dressings are alone worth many times the discomfort of a minor operation for its removal. The plate or band is never covered by bone sufficiently to require a chisel or bone forceps for its removal at the end of six weeks. We have had this experience in removing plates or bands where they have been in three months or longer and we do not believe they interfere with regeneration or callus formation within the above prescribed period of time (5 to 8 weeks) but that they are very liable to do this if they are left in longer.





There is no form of external splinting that in the average case will maintain apposition of fragments at 100 per cent. The very best only have a relative degree of efficiency but nowhere approach 100 per cent. We are reporting in this article only four cases illustrating the internal fixation especially in the distal end of the humerus. We feel that it is of special value in fracture of the humerus, certain fracture of the femur and in cases in which both bone of the leg are fractured and comminuted. If union fails in the compound fracture after internal fixation as it sometimes will, it will not have the extensive deformity or riding or infection which is so often difficult to overcome in operating for a non-union. Since the Parham Martin band is made smaller than formerly and of a much more malleable metal it is very easy to remove under a local anesthetic by enlarging the small sinus, tightening the hook end and curving



it to match the contour of the bone then extracting it with a pair of bone forceps. The plate requires a larger incision for its removal consisting of a number of different pieces (including crew) perforate the marrow cavity and consequently should never be used where the band will answer. If plates are used the crew holes should always be corrected when the crew are removed.

#### CONCLUSIONS

1. We believe that temporary internal fixation of compound fracture should be more frequently used than has been done in the past and that it will prevent many of the difficult reparative operation which we have to do on non-union compound fracture.

2. We do not believe that it increases the incidence of infection but reduces it in direct ratio to the fixation.

3. We do not believe that band or plate should ever be used with the understanding or hope that they will remain permanently.

4. The value of band and plate in preventing excessive deformity and in relieving pain between and during dressing is a very great asset.

5 We believe their use will occasionally prevent the loss of limb where the displacement is likely to interfere seriously with the circulation or nerve function

6 The Parham band is much to be preferred to the Lane's plate where it can be used because in oblique and comminuted fractures it is a

better mechanical support and brings all the fragments into perfect apposition and does not open the medullary cavity with the possibility of infection and osteoporosis

As complete external immobilization should be maintained as would be if internal fixation were not used

## METHOD OF EXTERNAL FIXATION FOR FRACTURED FEMUR

DAVID ELIASON, M.D., F.A.C.S., PHILADELPHIA

**A**PPECIATING the difficulty experienced in accomplishing satisfactory fixation in fractures of the femur I have endeavored to devise such a dressing

A dressing in order to be efficient must (1) fix both fragments as well as the joint above and below in whatever position is desired (2) permit proper bed care of the patient which means permit his being moved or turned without danger of strain at fracture site (3) provide dependable traction which can be maintained and the amount accurately registered at all times permit (4) of its application with the least possible concurrent danger of displacement of the fragments at the time and lastly allow a safe transfer of the patient from place to place

The means at our disposal for accomplishing the above results are the Hawley fracture table the direct bone extension pins or tongs a scale registering extension and a frame after the Bradford idea with modifications and extensions devised by the writer

The Hawley table is well known by surgeons doing bone work and needs no description

As further aids the writer has devised three additional appliances to be attached to the table. The first an adjustable extension that permits of traction in the extremely flexed thigh position which we sometimes need in fractures of the upper and lower extremities of the femur shaft

To counteract such upward pull use is made of the adjustable plate applied over Pou-

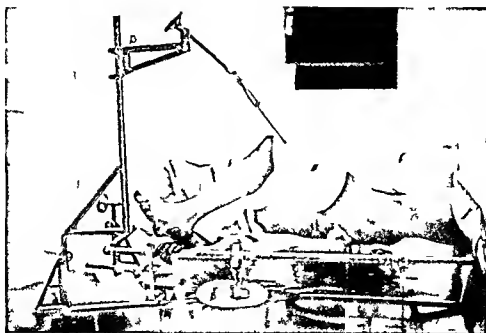


Fig. 1. Patient in position for application of bandage in fracture of femur



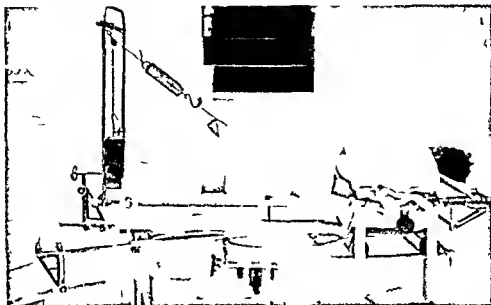


FIG. 3 The overhead bow adjusted to the frame

the counter plate is applied over the anterior superior spine. Properly placed screws hold it rigid in the perineal post.

We have a screw traction movable on a movable upright and a counter traction inguinal band or plate that grips the anterior superior spine of the ilium and prevents lifting the patient's buttock.

The extension or traction attachment *D* is a long heavy upright rod angled to swing free over the foot of the table. It fits into the socket of the foot clamp. At the top of the rod is an adjustable sliding bracket. To the extreme point of the bracket is fixed a tongued swivel socket through which passes a heavy threaded rod armed on one end with a hook by which traction is made. The swivel socket allows the screw traction to adapt itself to the line of pull.

The threaded rod is also grooved to accommodate the tongue of the swivel socket thus preventing rotation of the hook. Fitted upon the thread is a hand wheel by which the traction is regulated.

The counter traction plate is made of steel of sufficient thickness to be rigid. It is flat with a broadened fenestrated down curved end which makes it fit over the anterior superior spine.

The other end is slotted and adjustable by a binding thumb screw to a corrugated upright which fits into the perineal post of the Hawley table. It is attached at any desired height by a thumb screw on the foot side of the post and the post itself is attached to the table by a centrally placed thumb screw below the platform and toward the head of the table.

The plate is readily adjustable for either side any height and any length to fit different sized patients. By removing the binding screw it is easily slid out from under the plaster of Paris casing.

Traction may now be made to any degree of flexions or abduction that may be necessary and the fragments replaced by whatever method closed or open is being used. The number of pounds of traction is registered by an interposed scale and is continued for from 3 to 4 weeks the number of pounds pull varying with age of fracture amount of shortening size of patient and the type of fracture line.

The amount of pull or traction required to reduce a fracture increases enormously with age of fracture. After 10 days or 2 weeks there is a marked increase in amount needed to overcome the shortening for firm fibrous organization of the extravasated blood has occurred by this time binding the contracted muscle banks together.

The more shortening there is the more traction is needed. Old fractures with more than 1 inch shortening most frequently do not stretch much more than an inch to an inch and a half. These cases demand slowly increasing traction over a period of 15 to 30 minutes watching the patient closely as traction of 100 to 150 pounds shocks them severely.

Muscular adults with oblique or spiral fracture demand after reduction 30 to 40 pounds pull for few days then just enough to counteract the approximate judged weight of the limb from the fracture site down. Transverse fractures with end to end approximation require

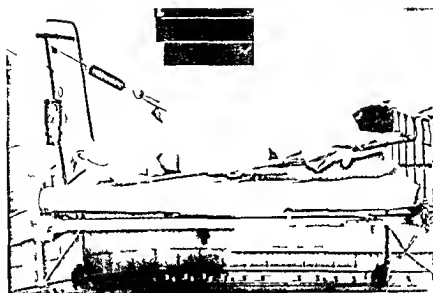


Fig. 4. Plaster cast of the leg and foot.

merely the traction arrangement, the limb weight.

The patient is now prepared for the plaster of Paris cast which extends from the umbilicus to and including the foot of the affected side and half way down the thigh on the uninjured side.

The table platform is then dropped and the head of the table is rolled toward the patient's head.

A thick padding of felt or empuce the pelvis with strips on each side of the perineum to catch the newly fitting plaster. The limb is encased in cotton wadding or flannel. The sole of the foot is padded with a thin layer of compressed cotton which rests momentarily on the foot support of the frame.

Plaster is now applied over all with the exception of the foot. A tourniquet is placed around the pelvis and a foot but few 4 or 5 hand rolls and bind the pelvis can a trap. Heavy reduplicate layers of bandage fill in upon the other should be applied and malleled along, both side of the pelvis. Down the back of the thigh extending under the buttock to form a support up to middle of similar reinforcement (Fig. 3).

After the cast is almost heavy enough the pelvic side brace is turned up little and the plaster and incorporated there with a few turns of plaster. On each side of the knee a metal band angled to suit the knee position and extending for 6 or 8 inches above and below are

also incorporated with plaster slightly back of the center line of the limb.

Placed under the foot or 3 inches from the sole and extending up above the ankle is a metal stirrup which is bound to the leg above and rests on the foot support below. Plaster now binds the foot to the foot piece. Thus it is seen that the cast support and weight is transferred directly to the frame and no weight is carried by the foot. This is exceedingly important a patient cannot endure prolonged even mild pressure on the sole of the foot.

The stirrup should be extended up the leg be kept back of the middle of the lateral aspect of the leg. The front half of the cast is now cut through from 1 inch below the groin to the toe thus making a deep trough.

The overhead bar is now adjusted to the frame and the extension transferred directly to it the lateral arm being adjusted to suit the direction of traction (Fig. 5).

Three rectangular bars are attached over the two pelvic traps. The frame and patient are lifted into bed (Fig. 4).

The patient is attached to the frame in his plaster cast at four places and the traction is also attached to the frame. This allows of lifting, turning and tilting of the frame.

Four iron S hooks are attached to the head of the bed at foot of bed are used to hold the frame off the mattress while the bed is changed or bedpan used. One and then the other pelvic strip (never both at same time) is removed and the back attended to.

# LATE PERFORATION OF A TYPHOID ULCER, LAPAROTOMY UNDER NOVOCAINE ANÆSTHESIA RECOVERY

BY H. C. COONEY, M.D., F.A.C.S., PRINCETON, MINNESOTA

**P**ATIENTS with typhoid ulcer perforation who are surgically treated and recover are still sufficiently few and far between to justify a brief clinical mention of such a case to stimulate careful examination and prompt surgical intervention when the clinical findings are such that perforation of the intestine is a strong probability, as an absolutely correct diagnosis in the early hours is beset with difficulties and textbook descriptions are misleading and furnish but little real guidance.

The occurrence of sudden severe abdominal pain with more or less shock, with or without nausea or rigidity of the right lower quadrant in the first two or three hours, together with a small rapid pulse, are clinical symptoms of the greatest significance. The temperature at first may be depressed but in a few hours in my case it was markedly elevated.

My patient, as a young male of twenty who had been ill with a protracted typhoid fever between ten and eleven weeks and was in a much emaciated and exhausted condition. The diagnosis of probable perforation was based upon the occurrence of sudden abdominal pain (requiring morphine), slight right iliac tenderness, small rapid pulse (135), marked elevation of temperature, 104—temperature taken four hours after onset of pain. There was no nausea nor abdominal rigidity. Exploratory laparotomy under novocaine (1 per cent) infiltration anesthesia, performed four hours after the abdominal pain was first complained of, and a perforation of the ileum six inches proximal to the ileocecal valve was demonstrated. It closed by a purse-string linen suture reinforced by an

omental graft as the bowel wall was too much indurated and unable to permit of invagination by the linen suture which served however to mechanically close the perforation again to immediate leakage. Not much soiling of the peritoneum had taken place. Around the perforation there was considerable fibrinous exudate on the gut. As the appendix allowed some fibrinous exudate and injection (by contact) and contained several enteroliths it was tied off with chromic catgut, the stump cauterized and a cigarette wick placed and the abdomen closed in layers. After twelve hours, water was given and milk and broth in twenty-four hours. No infection took place about the drain which was removed on the sixth day and an uninterrupted convalescence followed. Very little discomfort was experienced by this patient at operation under novocaine anesthesia.

The essentials are to infiltrate the skin or layer of tissue and then wait four or five minutes before division of the infiltrated layer, repeat this process until the abdomen is open. Use gentle traction (or better none at all) on the abdominal wall and mesentery and no pain of any consequence will be inflicted. Operate upon a reasonable probability of perforation. If we wait until we are absolutely certain of a diagnosis, i.e., signs which point to an evident peritonitis, that patient will most certainly die.

Exploratory laparotomy under novocaine anesthesia properly performed results in little shock or pain to the patient. Its use is advocated of course in the typhoid fever patient whose condition as a rule contra indicates any general anesthetic.

## AN ARMY CYSTOSCOPIC TABLE

BY CAPTAIN ALEXANDER HAMILTON LEACOCK, MEDICAL CORPS U. S. A., CAMP LEWIS, WASHINGTON

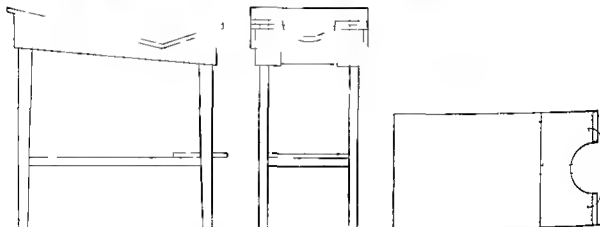
**O**NE of the busiest wards of the camp hospital serving the newly drafted army is the one devoted to urology. Many cases of chronic pyelitis are not detected by the examining board due to lack of time and lack of special examinations and the men are sent to camp and put to drilling with the result that some of them break down and are sent to the base hospital for diagnosis and treatment. Hence many cystoscopic examinations are found

necessary. In making these examinations one of the first things appreciated is a good cystoscopic table comfortable to both the patient and the examiner.

With the aid of several cabinet makers the table here illustrated was built. It is four feet long, four feet high and two feet wide. It is made of wood with well mortised corners and cross bars. It is very strong and rigid. The center of gravity is high but will be taken care of. The



Photograph of the stool and table



Drawing of the stool and table

table cannot be tipped. The patient reaches the top by means of a chair or a two step mount. The entire table takes up but little space. The feet do not slip off the heel rests proving very efficient. After the patient gets into position with the buttock well down he is told to relax fully as when the frog position knees wide apart. This table has proved to be a very great help making cystoscopy a pleasure as it does not tire the patient and is very easy on the cystoscopist. Should he prefer sitting on a high stool used by the examiner.

#### ADVANTAGES

1. The table is high enough so that the operator can easily demonstrate to others the various intravaginal lesions.

It is comfortable to the patient and comes closest to a posture of ease and relaxation the shoulders, small of the back and the buttocks being well supported.

3. Its construction is simple.

4. It can be made with lumber found around the new cantonments though hard wood or sheet and tubular steel would be more permanent.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

THE sphynx of the body has again been questioned and is again found uncommunicative. This silent anatomic guest the spleen has been a source of wonder and speculation for years. Much and little has been attributed to it but to date no tangible evidence is at hand to claim for it a rôle either in the production of disease or in maintenance of normal body functions. The authors of the work at hand<sup>1</sup> deserve untold praise for their untiring efforts in trying to establish some basic facts regarding the physiology of the spleen and its peculiar behavior under certain abnormal conditions. The experimental work carried on by Pearce is certainly painstaking and complete. Little is left to the imagination. By his experimental work certain facts are verified and definitely established. Many new avenues are opened and thoroughly explored only to find them barren. The subjects of post-splenectomy anemia increased cell resistance and decreased tendency to jaundice are thoroughly verified but no distinct and infallible reasons recorded. The practical clinical views of the spleen are presented by Krumbhaar holding constantly before the reader the result of experimental work in its relation to clinical findings and operative records. The spleen and its possible association to pernicious anemia is also discussed but withal nothing new is added. In a closing chapter Frazier in brief presents the surgical treatment of lesions of the spleen. J A W

TRANSFUSION of blood although used centuries ago has only in the past decade been perfected to such an extent as to place the procedure in the class of essentials. The early disastrous results were undoubtedly due to the lack of asepsis or to the lack in care in the procuring of blood which did not produce hemolysis or agglutination in the recipient. Bernheim's monograph is certainly opportune since blood transfusion is beginning to find its way into military surgery and at present is employed with good results in certain types of shock following injury on the battle field.

The author considers his topic from a practical viewpoint eliminating much technical detail. After discussing the phenomenon of bleeding and its

diagnosis he enters upon a logical and sane analysis of blood transfusion as it applies to various conditions. The technique of the transfusion of whole and citrated blood is given in a concise way. Dosage of blood and indications for its use are discussed. It is very apparent from the author's observations that transfusion is a valuable asset in the treatment of acute anemia due to loss of blood from bleeding and also in certain blood dyscrasias but not the cure all which certain men try to make it. It affords means for remissions in pernicious anemia, leukæmia, hæmophilia and the like but no evidence is at hand that a cure has ever been attained. Favorable results are procured in melena, neonatorum and hemolytic icterus the latter when associated with splenectomy. The author gives the Moss classification of blood and the technique for testing blood for hemolysis and agglutination by various methods.

The work is indeed a valuable addition to the surgical literature of the day and deserves study by every surgeon. J A W

THE study of the internal secretions is at present in full swing and yet but few tangible facts are at hand. The one gland about which the universe of internal secretion revolves the thyroid has been studied for centuries and today many of its peculiar functions and reactions are known. Yet the gland in its entirety along with its special pathology is yet a source of speculation. The work of Crotti<sup>2</sup> is surely a step forward as a systematic classification of our present day knowledge regarding this most essential organ. A short paragraph in the preface explains the attitude which the author assumes. Some may find my statements dogmatic at times and my conclusions perhaps a little singular. I feel however that in the study of the problems of internal secretion always tantalizing and interesting accessibility to ideas is the one prerequisite to success for those who wish to gain achievement in the study and so long as we have not secured the whole truth opinions are of value provided they are substantiated by facts.

It is indeed a difficult task to enumerate the outstanding parts of this admirable work since every phase of the goiter problem has been exhausted. It gives the reader much pleasure to know what is of historic interest regarding goiter and this subject



treated pleasantly. Having put many years of study and hard work into the subject and having gained intimate touch with the masters of the art, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease. In the history of the disease, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease. In the history of the disease, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease.

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Since the advent of new diagnostic methods and the refinement in diagnosis and operative treatment, urology has come into its own, not only as a specialty, but one which demands much training and skill. In spite of the fact that there are in the hands of the profession a number of volumes dealing with the subject, the new work edited by Cabot is an innovation. It is by far the most comprehensive study of its kind at present. The predominating spirit of this compilation is admirably expressed by the author in the preface as follows: "Our intention has been to give a concise expression to American urology and if in this we have been successful the object has been achieved." The work consists of 10 volumes by American authors. Volume I after an interesting chapter of historical introduction discusses the etiology and its relation to the diagnosis and prognosis of the urinary tract. Following this are considered details of the penis, urethra, scrotum, testicle, prostate, and seminal vesicle. Subdivisions of the contents are given in the following fifteen monographs by men of unquestionable ability and much new information is set forth. It is indeed pleasant to see a work on urology which is constructed along these lines and although there may be some repetition or difference of opinion yet it is the expression of the urologists of the day and will add to the interest of the reader.

The work is well illustrated and a complete bibliography is given at the close of each chapter.

One can unhesitatingly say that this work brings the subject of urology down to the minute. After reading you find that the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease. In the history of the disease, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease.

Ed. J. H. U. C. b. O. D. T. A. C. S. Phil. I. I. Ph. d. N. Y. L. & F. I. A. I.

FOR many years, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease. In the history of the disease, the author has not only obtained a high rank among the many, but has also obtained a high rank in the subject of the history of the disease.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## ANKYLOSIS OF THE JAW<sup>1</sup>

By M. S. HENDESON, M.D. and G. B. NEW, M.D. ROCHESTER, MINNESOTA  
From the M. J. C.

THE different methods employed in the treatment of ankylosis of the jaw and the length of time elapsing before patients apply for treatment after almost a complete fixation would seem to indicate that the good results obtained by arthroplasty of the temporomaxillary joint are not generally known.

During the last eight years at the Mayo Clinic 3 cases of ankylosis of the lower jaw have been treated 14 within the last three years. Depending on the location of the fixation such cases divide themselves into three groups (1) the articular type in which the joint alone is involved (2) the extra articular type in which the fixation is extra articular such as scarring in the muscles of the cheek or temporal region and (3) the articular extra articular type in which the cause of the ankylosis is both within and without the joint. Of the 3 cases 15 were articular 5 extra articular and 3 articular extra articular. Twenty two resections of the condyle were done 19 in the articular cases and 3 in the articular extra articular cases.

### ETIOLOGY

The etiology of the articular cases of ankylosis is either traumatism or infection extending into the joint by direct extension or by the blood stream. Blair in reviewing the literature of the articular variety of ankylosis states that 50 per cent of the cases

are due to trauma on the chin. In our group of cases only 3 (20 per cent) were due to this cause. Murphy states that most cases of ankylosis of the jaw are due to extension from middle ear infection directly into the glenoid cavity or over the base of the zygoma into the joint. In one only of our cases was an ear infection the probable cause of the ankylosis. A child developed a running ear after scarlet fever and this was followed by ankylosis of the jaw on the same side. Table I shows the various causes to which the condition is attributable in our group of cases.

TABLE I  
TWENTY THREE CASES

<i>Articular</i>	15
Trauma of the chin	3
Recurrence of location of jaw	
Osteomyelitis	
Scarlet fever	
Measles	
Abscess of cheek or articulation	1
Arthritis	1
Not stated	
Fever	1
Typhoid	2
Tonsillitis	1
Diphtheria	1
<i>Extra articular</i>	5
Infection of cheek from teeth	1
Slough of cheek from salivation	1
Abscess of temporal region cause unknown	
Temporomaxillary abscess from wisdom tooth	
<i>Articular extra articular</i>	3
Thrombosed tonsillar abscess and quinsy	1
Abscess out of the mouth from teeth	1
Base of the jaw joint and secondary abscesses	

It should be remembered that on account of the early age at which this condition often occurs it is sometimes difficult to secure a clear history of the cause of the trouble. In the extra articular cases some fixation in the muscles or structures about the joint such as carrying of the muscles of the neck or temporal region secondary to abscessed teeth tonsils etc. caused the ankylosis. In one case the fixation was inside the lower jaw owing to the carrying following quinsy and attempted tonsillectomy.

In most cases the age of the patients at the time of the occurrence of the articular type of ankylosis of the jaw was under 10 years.

TABLE

A	C
1	1
2	1
3	1
53	1

The age of the patient at the time of the occurrence of the extra articular and articular extra articular types are shown in Table 3.

TABLE 3

A	C
1	1
2	1
3	1
4	1
4	1

In the latter group the condition seemed to be about equally divided over the first five decades. In the articular group 9 of the 15 cases occurred in patients under 10 years of age. Taking these two groups together it is seen that nearly 50 per cent of all cases of ankylosis of the lower jaw occurs in the first decade. As may be noted in Table 4 most of the patients do not come for operation until they are between 21 and 30 years of age.

TABLE 4

A	C
1	4
2	6
3	1
3	1
3	1
4	1
4	1
5	1

#### PATHOLOGY

The growth of the ramus of the jaw is largely dependent on the epiphysis of the condyle and any fixation of this with conse-

quent loss of function interferes with the development of the jaw on the side affected. The underdevelopment and shortening of the affected side causes the typical deformity seen in such cases. The center of ossification of the condyle does not unite with the ramus until the fifteenth year. Injury to or fixation of the condyle before the jaw is fully formed would cause the lack of development of that side. In the fibrous type of ankylosis fibrous adhesions occur in the joint while in the bony type the entire joint is sometimes obliterated and the condyle and zygoma form one mass of bone with no definite landmarks. In the extra articular group the scarring prevents the normal elasticity of the muscles usually the temporal masseter or pterygoids and thus limits the movements of the jaw.

#### PHYSICAL FINDINGS AND DIAGNOSIS

The case of unilateral ankylosis of the lower jaw if the condition has occurred before the jaw is fully formed presents a typical picture (Figs 1 and 2). The chin is markedly retracted and is displaced toward the affected side which appears full and rounded while the normal side is flattened. The midline of the lower jaw is displaced to the affected side and when the patient separates the teeth there is any movement of the jaw the midline moves to this side. Roentgenograms of the ascending ramus show a shortening of the ramus of the affected side (Fig 3). If the ankylosis is bilateral or has occurred after the complete development of the jaws then the findings are altered. In the latter group of cases it is sometimes impossible to differentiate the side involved from the physical finding alone. A differentiation between a bony and fibrous ankylosis is usually readily made as the bony type allows of practically no movement of the jaw. The amount of movement that can be obtained in unilateral bony ankylosis at times is surprising. In bony ankylosis a definite diagnosis of the side affected can only be made if the condition has occurred early in life when there is typical deformity or when the patient's history shows definitely the side affected if there is no deformity.



Fig. 1 (at left) Bony ankylosis of right lower jaw. Note retrusion and displacement of the chin to the right and the flattening of the left side of the face.  
Fig. 2 Same as Fig. 1 after arthroplasty.

In older patients with fibrous ankylosis a very slight movement of the jaw will sometimes serve to establish the affected side. Roentgenograms of the joint itself are usually of little value as the physical findings are sufficient to determine whether the ankylosis is fibrous or bony although occasionally a roentgenogram is obtained from which a diagnosis of bony ankylosis could be made from the plate alone. Nine of the 15 cases of articular ankylosis in our group were bony and 6 fibrous.

Little was noted in the literature of the clinical differentiation between the articular and extra articular types of ankylosis though usually such differentiation is not difficult. Two of our patients (adult men) in whom there was no deformity serve to illustrate this point. The side affected was easily determined by the divergence of the jaw to the side affected when the teeth were separated the condyle on that side having very little movement while the opposite side moved quite readily. In one of the patients the ankylosis came on after attempted tonsillectomy and recurring quinsy and in the other following a recurring abscess of the

check outside the ascending ramus. In both instances it was impossible until the joint was explored and resected to determine that the ankylosis was the result of two factors namely the articular and the extra articular. The question of the coronoid process being the cause of any fixation was readily ruled out in these two cases. There was sufficient scarring in one case inside the ramus and in the other outside the ramus to prevent the teeth separating more than 1 inch.

#### TREATMENT

For many years excision has been the surgical procedure for ankylosis of the temporomaxillary joint. In the main the results have been satisfactory but the occasional failure has spurred surgeons to modify the technique. The impetus given by the late J. B. Murphy to the use of a flap of autogenous fat or fascia in arthroplasties has led the majority of writers to recommend the placing of such tissue between the denuded bone ends when operating on the jaw for ankylosis. Baer has advised the use of chromicized pig's bladder and reports good results.



FIG. 3. Incision line for the removal of the articular surface of the mandible.

FIG. 4. Mandible after the removal of the articular surface.

Excision of the joint is however the basic principle of each method advised. Any operation which is designed to give motion to a previously ankylosed joint or one in which the motion is sufficiently restricted to prevent the function of the joint should be called an arthroplasty whether the technique of such operation demands merely the removal of enough bone to allow motion or whether it includes as a step the interposition of fat, fascia or some foreign substance between the bony surface to prevent subsequent ankylosis.

The operation herein described is an arthroplasty because it has as its object the establishment of sufficient motion to permit function of the part affected. The facial nerve and the internal maxillary and superficial temporal arteries are the structures the surgeon must bear in mind and familiarize himself with before undertaking the operation. The facial nerve after it leaves the stylomastoid foramen passes downward outward and forward through the parotid gland and divides just posterior to the ramus of the mandible into the terminal branches the temporofacial and the cervicofacial. It is to the former branches that damage is most likely to be done during the operation under

discussion. These branches run upward and forward from just below and in front of the external auditory meatus as they arise in the parotid gland from the main nerve. The external carotid artery branches into the superficial temporal artery and is continued on as the internal maxillary. The superficial temporal branch runs straight up to the temporal region being superficially placed close to and in front of the external auditory meatus. The internal maxillary artery is deeply situated and on its way to the pterygoid fossa of the sphenoid bone courses close to the inner side of the neck of the ramus of the mandible (Fig. 4). It is not especially liable to injury and is well out of the way if during the operation all work is kept close to the bone. Some little bleeding may occur from the articular branches which are given off but picking with a hot salt sponge for a minute or two controls this if it prove to be annoying. If the bleeding is persistent and considerable in amount it means that damage has been done either to the superficial temporal artery which lies behind or to the internal maxillary itself.

Taking these anatomic structures into consideration it will be seen that there is a

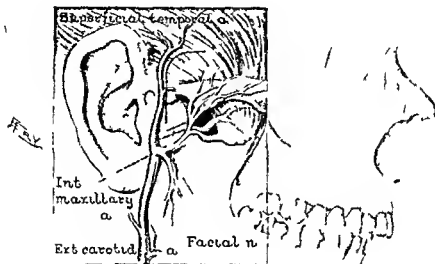


Fig. 4 Note the superficial temporal artery, internal maxillary artery, facial nerve and the location of the incision.

triangular area with the base upward lying over the temporomaxillary joint which is practically devoid of important anatomic structures and permits a ready and safe approach to the joint. To carry out the safety first idea to its completion as regards the facial nerve the approach should be consistently made from above and in order to do this the lower portion of the zygoma over the joint must be sacrificed but a bridge is left so that no deformity will result. This approach is particularly of value in a case with marked deformity in which the joint is very low and in order to expose it directly it would be necessary to injure the facial nerve. Hartley has described an operation very similar to that used by us

except that he begins the incision behind and turns the ear down thus necessarily dividing the superficial temporal artery a matter of very little consequence however.

The incision used by us is curved and about inches long. Its anterior and upper portion runs one half inch above and parallel to the zygoma. The posterior arm extends downward just in front of the ear to about the level of the floor of the external auditory canal. This skin flap is partially dissected free in order to expose the zygoma. If necessary the superficial temporal artery may be divided. An incision parallel to the zygoma and directly over it is made and the temporal fascia is retracted downward exposing the zygoma and the joint region. The

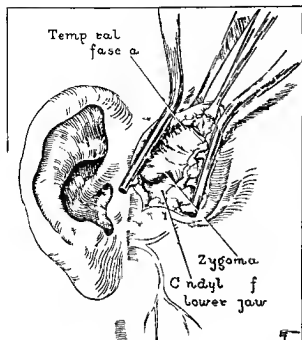


Fig 5 Th yg m th l t m dg l  
t t h ld th ft t  
1 f d th fl t

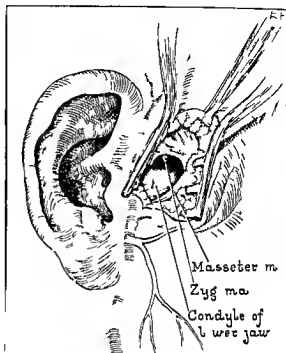


Fig 6 Th yg m th l t m dg l  
b ll p f th m l f th d l \ t  
m ll b l f yg m m g

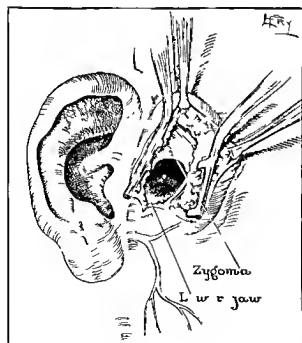


Fig 7 Th dyl l m d l g tl p  
b t tl 11 l f tl l m d k ll

entire flap is then turned downward and forward carrying with it and holding out of the way of injury the temporofacial branch of the facial nerve. The safest form of retraction is by the use of a self-retaining retractors placed obliquely in the wound (Fig 5). If the retraction is left to an unskilled assistant he may in his zeal for exposure use too much force and a temporary facial palsy will occur the result of stretching. The next step consists in the removal of the part of the zygoma directly over the joint area care being taken not to injure the external auditory canal and to leave a small bridge of the zygoma to maintain facial contour. This exposes the condyle and it can be removed with a chisel gouge (Fig 6). The bone to be taken out should be carefully removed by chiseling off small pieces. If rongeur forceps are used and bits taken and the bone is twisted out the internal maxillary artery may be injured. It not infrequently happens that when there is a bony ankylosis the ramus and even the coronoid process is involved in the ma-



Fig 8



Fig 9

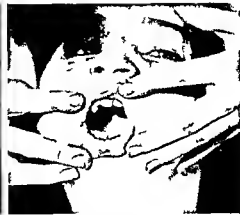


Fig 10

Fig 8 Fibrous ankylosis of the right lower jaw. Note displacement of the middle of the lower jaw to the right.  
Fig 9 Note typical retrusion of the chin. Same case.

as Figure 8. Also note scar from operation of arthroplasty.

Fig 10 Same as Figure 8 after operation.

A large quantity of bone must then be removed and a space at least one half inch in width must be left between the neck of the ramus and what formerly was the glenoid fossa (Fig 9). If the coronoid process is involved a sufficient amount of it must be removed to permit free motion. This can be done by working forward through the same exposure. No fascia fat membrane or foreign material of any kind is placed between the end of the mandible and the temporal bone. When the bone is removed and motion secured the wound is closed.

If after the completion of the arthroplasty sufficient motion has not been obtained in a case in which there is no facial deformity and in which it has not been possible definitely to determine the side chiefly affected the surgeon is forced to conclude that the other side is at fault in which case the second side should be operated on later. On the other hand occasionally after the removal of bone the amount of motion obtained has been disappointing though there has been no question but that the side operated on was the affected side. In such a case the trouble is in the muscles and peri-articular structures. Too vigorous attempts to open the jaw widely with the mouth gag or the threaded block of wood are to be condemned for the teeth are often broken needlessly. By patiently forcing the mouth open each day with a mouth spreader motion will steadily improve. The patient himself uses this

spreader. He is encouraged to chew gum and thoroughly to chew meat preferably tough meat at his meals (Figs 8, 9, 10 and 11).

#### RESULTS

Nearly all the 15 patients on whom arthroplasties were performed have done well. During the last three years in all the cases which include ten articular and two articular



Fig 11 Note the threaded block of wood used to operate the teeth after operation.



extra articular from one inch to one and three quarters inch separation between the teeth with good free movement has been obtained. In some of the earlier cases the results were not quite so good. With improvement in technique the results have been better. As applied to our entire group of cases the operation described has been uniformly satisfactory.

In the articular extra articular cases equally satisfactory results have been obtained although the carrying in the muscles has prevented the wide separation that was obtained in the other. In all of the cases however there is at least 1 inch separation between the teeth.

The extra articular case present a different problem they are not benefited by the operation under discussion and our best result have been obtained by forcible stretching under ether.

#### CONCLUSION

We believe that the essential points in this method of treating articular ankylosis are

1. Removing sufficient bone to make a space one half an inch between the knoll and the ramus and thus obtaining a stable functioning joint.

2. An incision that gives good exposure

to the joint and does not injure the facial nerve.

3. Approaching the joint from above by removing part of the zygoma.

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## THE RÔLE OF ASCARIASIS IN GALL-BLADDER DISEASE

BY J AVILES MD FACS SAN JUAN PORTO RICO

THE ascaris lumbricoides is found in almost every part of the world except perhaps Iceland. The most common host of the parasite is man; its life history begins immediately the ova are ingested and it occupies the upper part of the small intestine. Usually no more than one or two are present but they may occur in large numbers. Raines (1) describes the unique case of a child of 20 months who discharged 834 worms in one day, 634 the next day and within a short period 199.

The pathogenic power of the ascaris lumbricoides depends upon the following factors:

1. In all probability a toxin. Herrick (2) produced a remarkable eosinophilia by the intraperitoneal injection of an aqueous extract of ascaris lumbricoides and demonstrated that the substance producing such an eosinophile increase was a protein. Flury (3) has shown that the tissues and excreta of this worm contain numerous compounds capable of inducing local hyperæmia, inflammation and necrosis.

2. Migration of the parasite. In this way the micro organisms are carried from their habitat—the small intestines—to other parts of the body causing infections. Infection is especially common when the parasite migrates to the bile passages.

3. Mechanical disturbances. The recorded cases of mechanical lesions caused by the parasite demonstrate that the worm is a potential factor in the production of dangerous complications. Although such lesions are rare, Kemp (4) cites cases of fatal asphyxia by the entrance of the worm into the larynx or into the trachea and lungs causing gangrene. They have perforated intestinal ulcers and some claim that even the healthy bowel wall has been perforated by them. Appendicitis has been attributed to the ascaris and obstruction of the bowel is said to have been produced by an accumulation of a large number of ascandes.

Twenty cases (5) are on record in which

round worms have entered the urinary passages, nine cases the pancreatic duct and over ninety cases the bile ducts. The literature (6) mentions a few cases where the parasite migrated into the gall bladder.

Tonnek (7) has found an ascaris partially in the common duct and partially in the duodenum without causing any symptom during life and at autopsy disclosing no signs of inflammation or biliary stasis. Nevertheless it must be admitted that in this latter condition the worm found in the common duct was there for a short time only. Under the same conditions symptoms of inflammation of the biliary passages have arisen during life. Lieutaud (8) reports a case of a boy of fourteen years who was seized by hepatic colic like pains, tenderness over the epigastrium and hepatic region, high fever accompanied at the same time with salivation and icterus. The fæces became colorless, the pulse intermittent. Death occurred after convulsions. At the autopsy the liver was found to be yellow and swollen, the gall bladder very distended with bile, the ductus choledochus obstructed by a large ascaris lumbricoides. The stomach and intestine contained many entozoos of the same species. Bounapart (9) of Pisa reports a case of icterus which ended fatally, the cause of the death being the presence of an ascaris lumbricoides in the common duct.

The round worms are found more frequently in the gall bladder, hepatic duct and its branches inside the liver than in the ductus choledochus. In many instances (10) they have been found in great numbers giving symptoms of biliary stasis, dilatation, catarrhal inflammation and sometimes ulceration of the ductus and suppuration of the liver. Exceptionally there have been found dead, shrunken ascarides lumbricoides forming the nucleus of biliary calculi.

Lorry (11) found in the gall bladder of an insane patient who had been seized with convulsions, three large ascarides lumbricoides.

The patient had vomited one entozoon of the same species before death. Block and Heaveside have seen parasites isolated in the same organ. Cruveilhier (12) observed in a woman who died of pneumonia two large ascarides at the bifurcation of the hepatic duct and three more in its branches. The autopsy revealed no lesions in the liver and during life no symptom was noticed which would lead one to suspect the presence of these parasites in the biliary passages. Cuersant (13) cites the case of a child suffering with mild colic like pains who died suddenly with convulsions. The autopsy demonstrated no pathology except the presence of two ascarides lumbricoides about 7 to 8 inches in length in the hepatic duct and its branches. Broussais (14) relates the case of a soldier who died after fifteen days of illness. He had suffered with pain over the epigastrium and hepatic region, high fever, nervousness, icterus, convulsions, etc. The autopsy revealed a large ascaris lumbricoides in the common duct and another smaller one in one of the branches of the hepatic duct. Rupture of the ductus choledochus has been caused by these worms. A collection at Vienna has one specimen of this kind. Fontaneilles (15) and Lorrentini (16) have reported some observations of the same character. There have been found lumbricoides inside the liver in smooth round cysts without any sign of suppuration. In other instances there have been found rugosity and ulceration of the cavity. These cavities are formed partially by the dilatation of the ducts the parasites by entwining and matting together forming the contents. Laeunce (17) has reported the case of a child two and a half years old in whom the biliary ducts were found very much dilated and full of ascarides lumbricoides with no bile the mucous membrane reddened and in some spots ulcerated and completely destroyed in others the ascaride therefore were in immediate contact with the parenchyma of the liver. Many cavities formed in this way were the size of an almond. Kirkland (18) cites a case observed by him in which an abscess opened through the skin at the right costal margin of the false ribs

giving exit to a lumbricoides. Afterward a biliary fistula was established proving that the helminth came from the bile ducts. The history of our case is as follows:

The patient was a female of 38 years married the mother of five children. The menstrual period had been normal and there had been no abortion. The patient says that since she was twelve years of age she has been suffering from attacks of colic like pain over the right upper quadrant of the abdomen and she occasionally vomited stomach secretion mixed with bile. She has been expelled in some occasions round worms with the vomiting and in one instance the omitting of an ascaris relieved the pain. The attacks of pain have been more frequent since last December and for several days have been continuous and very painful. She complains of some kind of reaction over the chest and difficulty in respiration during attacks of colic.

She was admitted to the Municipal Hospital December 3 complaining of very acute pain over the epigastrium and in the hepatic region radiating to the left and right shoulder, tenderness along the right costal margin, slight icterus, moderate fever, pulse 102. Urine examination no albumin, no gall stones, no bile pigment present.

A probable diagnosis of cholecystitis with calcification was made.

Operation. The gall bladder found much distended with no adhesion to the liver. About five uncus of bile was aspirated. Cholecystotomy performed. The wall of the bladder exceedingly thick but no rotteness of the mucosa apparent. We did not find any calculi but a big ascaris lumbricoides about 8 inches in length partially obstructing the cyst duct. The operation completed by draining the gall bladder. The patient made a very favorable recovery and all the symptoms existing prior to the operation disappeared. Art helminthic remedies were administered during the convalescent period.

#### CONCLUSIONS

Our conclusions are

1. The diagnosis of gall bladder or of biliary duct disorders due to migration of ascarides lumbricoides is not easy.

Such disturbances are rare. At times the prognosis is grave and in some instances cases end fatally in a very short time. In others death comes suddenly.

3. An individual who is seized with hepatic colic like pain accompanied with vomiting of ascarides lumbricoides has the syndrome necessary for suspecting that the case is one of migration of the parasite or parasites into the biliary ducts or gall bladder and unless

the symptoms subside surgical intervention is indicated

4 Anthelmintic remedies must be administered as a prophylactic measure in those cases in which a history of ascariasis accompanies disorders of the gastrohepatoduodenal system

5 In those cases in which surgical intervention has been practiced anthelmintic remedies must be given to avoid new serious complications

The main object of this article is to add my case to the very few found in the literature on *ascaris lumbricoides* the etiology of which is found in another pathological entity as cariasis

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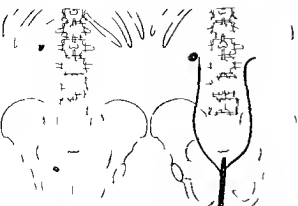
## UHL DIAGNOSIS OF URETERAL CALCULI

By DANIEL EISENDRATH AB MD FACCS CHICA

**T**HL personal observation of nearly forty cases has convinced me that but little reliance is to be placed upon clinical symptoms in the diagnosis of ureteral calculi. The syndrome known as renal colic with its radiations of pain to the testis and lower urinary tract was formerly regarded as almost pathognomonic of ureteral lithiasis. Further experience has shown that any lesion which will suddenly cause an increase in intrarenal tension will give rise to the identical group of symptoms. Typical renal or more correctly ureteral colics are now known to be present (a) when particles of tumor mass escape into the ureter (b) when blood clots or pus detritus is passed from the renal pelvis into the ureter (c) in cases of renal or ureteral infection (d) in nephritis (e) in appendicitis when the ureter is in close proximity to the inflamed appendix (f) in tubes (g) in strictures of the ureter whether of congenital or acquired origin (h) in kinking of the ureter as observed in cases of

movable kidney or compression of the ureter<sup>2</sup> by an accessory artery to the lower pole of the kidney. Nor does the symptom of fixed pain over the kidney or along the course of the ureter fare any better. In a recent analysis of the symptoms of a large number of cases of ureteral calculi from the Mayo Clinic Braasch and Moore<sup>3</sup> found that pain was referred largely to the kidney in 67 per cent to the upper abdominal quadrant in 15 per cent and to the region of the lower ureter or bladder in eleven per cent. No definite radiation of pain was observed in 5 per cent and no pain whatever in per cent. We thus see that the symptoms of a fixed pain in ureteral calculi independent of colicky attacks is distributed over such a wide area in the abdomen that there is no characteristic localization or radiation. The fact that ureteral calculi can be present for many years without giving rise to any symptoms at all

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makes it incumbent upon us to study the urinary tract in every thorough examination of the abdomen especially when there is a history of colics fixed or radiating pain or of microscopic or macroscopic hematuria. It is only through the employment of some or all of the methods of diagnosis which have been developed in the special field of urologic surgery in the past ten years that we are able to differentiate the various diseases of the urinary tract which can give rise to symptoms identical with those of ureteral calculi. The chief object of this paper is to make a plea to my surgical colleagues for the more frequent use of the modern methods of diagnosis of ureteral lithiasis such as the X ray study of the urinary tract with the aid of (a) the shadowgraph catheter (b) ureterography or pyelography (c) stereoscopic plate method (d) the results obtained by cystoscopy and ureteral catheterization and finally (e) intensification of suspicious shadows.

I have had no experience with the use of the wire tipped catheter so am not prepared

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to give an opinion as to its value as a diagnostic aid in ureteral calculi. To demonstrate the necessity of the more or less routine use of four of the five special methods just mentioned in the differential diagnosis of ureteral calculi I desire to report some typical cases.

### SHADOWS WITHIN AND EXTERNAL TO THE URINARY TRACT COMBINATION OF TRUE INTRARENAL AND PELVIC EXTRA URETERAL SHADOWS

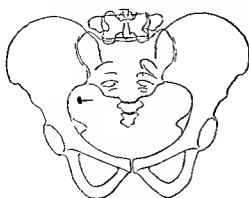
CASE Female age 30 with history of pain over kidney of many years duration. The X ray showed several shadows apparently within the pelvis of the kidney and a shadow in the pelvis on the same side as the renal shadow. No X ray catheter was employed to differentiate shadows situated whether they were within or external to the urinary tract. Operation revealed calculi in the renal pelvis but exploration of pelvic portion of ureter showed that lower shadow was due to a calcareous nodule in ovary. If the X ray catheter and other differential diagnostic method had been employed exploration of pelvic portion of ureter would have been unnecessary. A study of the X ray plate after operation also showed that the lower shadow was not of uniform density as is true of renal ureteral calculi and this alone should have made us suspicious that the shadow was extra ureteral (Fig. 1).

CASE Male age 23 with history of rigidity of blood X ray plates showed calcification passage of blood and shadows of uniform density in right kidney region and a small round shadow on either side of the true pelvis along the course of the pelvic ureter. The latter two shadows were at first thought to be ureteral calculi but upon taking another set of plates with an X ray catheter inserted into each ureter it was evident that the upper shadow in the kidney region was intrarenal but that the other two shadows were due to phleboliths that extend extra ureteral.

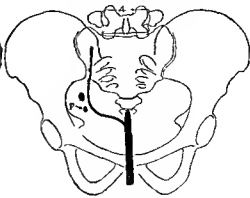
Both of these cases show the necessity of not arriving at a hasty conclusion that because the patient has a shadow within the urinary tract other shadows must also be shadow of a true intrarenal or intra ureteral character.

### HOW TYPICAL HISTORY AND APPARENTLY INTRA URETERAL SHADOW MAY LEAD TO WRONG DIAGNOSIS

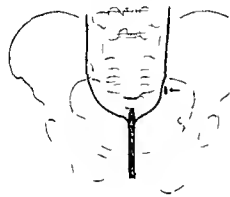
CASE Male age 64. Onct ne year before the pain on left side began radiating to the bladder. The X ray showed a relatively large oval and a small round shadow along the course of the pelvic ureter in the left side. On account of the presence of pain above the course of the left ureter



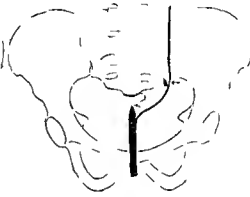
Fi 3



Fi 4



Fi 5



Fi 6

Fig 3 Case 3 Oval shadow thought to be intra ureteral because of typical right sided symptoms Passage of X ray catheter thought not to be necessary At operation found to be extra ureteral (See Fig 4)

Fig 4 X ray tracing of Case 3 after passage of shadowgraph catheter showing shadows to be extra ureteral phleboliths P

Fig 5 X ray tracing of Case 4 showing extra ureteral location of shadow Compare with Fig 6

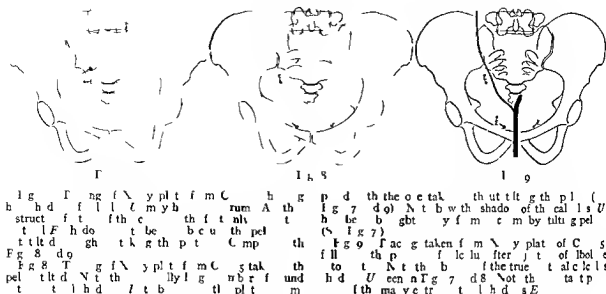
Fig 6 X ray tracing of Case 4 showing how shadow seemed to be tilted by X ray catheter at second introduction Compare with Fig 5

and the oval shape of the upper shadow (Fig 3) the passage of an X ray catheter was thought to be superfluous At operation two large calcareous plaques were found in branches of the internal iliac vessels immediately adjacent to the pelvic portion of the ureter

This case emphasizes the fact that no matter how typical the history or the shape of the shadow we could have avoided an operation in this case had we taken the trouble to use the differential diagnostic measures which are now generally accepted as being necessary in such cases namely passage of X ray catheter ureterography and stereoscopic X ray plates Although we felt before operation that the lower shadow because it was so distinctly round in outline must surely be a phlebolith the oval character of the upper shadow greatly resembled

that of many ureteral calculi An X ray catheter passed after operation showed the shadows to be extra ureteral (Fig 4)

CASE 4 Female aged 60 Principal symptom pain in pelvis especially upon urination An X ray taken by an expert radiographer in her home city showed a large triangular shadow on the right side of true pelvis The diagnosis made by her physician was ureteral calculi Urine from right ureter showed a few pus cells In order to avoid an error in this case in spite of the fact that the shadow being triangular did not resemble that of calcareous deposits in an extra ureteral structure we introduced an X ray catheter into the right ureter and this showed a distinct space between the catheter and the shadow (Fig 5) We also concluded because of the irregular density that is alternating darker and lighter areas in the shadow that it was a calcified pelvic lymph gland Further study of the X ray plate with the shadowgraph catheter *in situ* made us feel however that such a triangular shadow



could not be extra ureteral and we introduced an X-ray catheter a second time and this apparently tilted (Fig 6) the shadow in such a manner as to lead us to believe that it was intra ureteral. At operation a calcified nodule about the size of a split pea was found lying just external to the juxta-vesical portion of the right ureter.

In this case we were influenced in our judgment of the extra ureteral character of the shadow by the fact that the X-ray catheter apparently caused a change in position of the shadow. Had we employed the two additional methods to be referred to a little more in detail later, namely ureterography and a stereoscopic X-ray we would have avoided an error in this case.

#### COMBINATION OF TRUE INTRA URETERAL AND EXTRA URETERAL PELVIC SHADOWS

**CASE 5.** Male age 44 with history of repeated severe right ureteral colic accompanied by hematuria. The first X-ray was taken with the pelvis tilted but little and when the plate was studied it was seen that one shadow (Fig 7) was obscured by lying over the shadow of the sacrum. The observation showed the advisability of studying our X-ray plates of the urinary tract when they are dry and to note whether shadows lie over the pelvic bones a condition to which Cabot as the first to call attention. The second X-ray plate showed a much larger number of shadows, some of which had been obscured by a shadow of the anterior or of the bony pelvis lying before the pelvis had been tilted. A number of the shadows were typically round character and were readily recognized as phleboliths (Fig 8) that is extra ureteral. The shadow which

in the first X-ray plate had been obscured by that of the sacrum was shown in the second plate to be free of the sacrum (Fig 8). The history of repeated colic and the presence of blood in the urine both macroscopically and microscopically made us feel however that one of the shadows must be due to a calculus lodged in the pelvic portion of the ureter. A plate was not taken than an X-ray catheter was introduced before nonoperative measures for removal of the calculus were instituted. One ounce of alboline was injected into the right ureter and was soon followed by the passage of a small calculus of the uric acid type. The X-ray taken about two weeks after the passage of this calculus showed that one of the shadows was now the one (Fig 9) which in the first plate had been obscured by the sacrum and in the second one was seen to lie free of the bone. It must have been an intra ureteral shadow due to the calculus which the patient passed because all of the extra ureteral calcifications were still to be seen but this one was absent.

This case shows that both intra and extra ureteral shadows may be present in the pelvic portion of the ureter and their nature can only be ascertained with certainty by the use of the three differential methods frequently mentioned in this paper. Had we taken a stereoscopic X-ray with a shadowgraph catheter *in situ* supplemented perhaps by ureterography we would have had no difficulty in differentiating this extra from the intra ureteral shadows.

**CASE 6.** Extra and intra ureteral pelvic shadows. The diagnosis was made by X-ray catheter ureterogram and stereoscopic plates. Male aged 39 had two attacks of hematuria without other

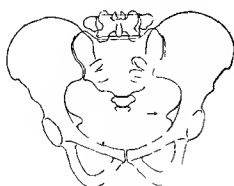


Fig 10

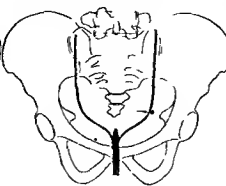


Fig 11

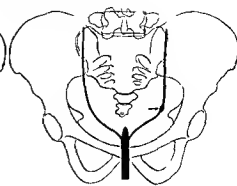


Fig 12

Fig 10 X ray tracing of Case 6 showing presence of extra ureteral and intra ureteral shadows (Compare with Figs 11 and 12)

Fig 11 X ray tracing of Case 6 showing all shadows seen in Fig 10 to be extra ureteral except one to which

arrow points This shadow is shown to be intra ureteral by ureterogram (Fig 12) and stereoscopic roentgenography.

Fig 12 X ray tracing of Case 6 after introduction of argentide into ureter. Note nodular dilatation at location of the intra ureteral shadow seen in Fig 11

symptoms referable to urinary tract. The X ray showed a large number of shadows on both sides of true pelvis (Fig 10). Cystoscopy and ureteral catheterization as well as pyelography failed to reveal the presence of any inflammatory lesion in the urinary tract. The X ray catheter showed that one of the many pelvic shadows was in contact with the X ray catheter (Fig 11). In order to confirm the fact that this shadow was intra ureteral, i.e. due to a calculus, stereoscopic plates were made and also some argentide solution permitted to flow through the ureteral catheter. This latter diagnostic method showed a characteristic nodular dilatation (Fig 12) opposite the calculus. The stereoscopic plates also confirmed the intra ureteral character of the shadow.

The use of all three of these methods in any case of suspected ureteral calculus is of the greatest value in cases where the shadow lies in the true pelvis. I can fully endorse the statement made by Hyman in a recent article<sup>1</sup> to the effect that these three procedures, the use of the opaque catheter, stereoroentgenography and ureterography, enable us to reduce the possibility of error to a minimum. Hyman believes that of the three methods the most reliable and valuable is stereoroentgenography with the catheter *in situ*.

#### DIFFERENTIATION OF SHADOWS IN COURSE OF UPPER URETER

The employment of the X ray catheter combined with ureterography or pyelography is of the greatest value in order to differentiate shadows due to extra ureteral conditions such as calcified lymph glands, gall stones, and

other lesions giving rise to shadows along the course of the iliac and lumbar portions of the ureter. The following two cases will serve to demonstrate the great value of these two methods.

**CASE 7** Shadows of calcified lymph glands from those of ureteral calculi. Male age 63. History of increased frequency and painful urination for several months. He had several attacks of severe pain in the right ilio-costal space radiating upward and accompanied by chills and fever. The X ray showed a number of shadows just above the crest of the ilium on the right side. On account of the variation in density of the individual shadows they were thought to be extra ureteral (Fig 18) and this was confirmed by passage of the X ray catheter which showed them to be separated from the opaque catheter by a clear space.

This alternation of darker and lighter areas in the shadow is according to my observation quite characteristic of calcified lymph nodes.

**CASE 8** Differentiation of gall stones and ureteral calculus. Male age 30 operated on for gall stones one year before onset of present illness. Gall bladder removal followed by uneventful recovery. One year later pain of a colic like nature in right upper abdominal quadrant thought at first to be due to recurrence in biliary tract. The X ray showed an oval long shadow of uniform density (Fig 13) along the course of the common duct but the passage of an X ray catheter confirmed the intra ureteral character of the shadow as that of calculus in the upper portion of the lumbar ureter (Fig 14). Removal of this calculus at later date. The uniform density was the first indication that the shadow could not be a gall stone because in the latter the shadow usually has a dark periphery and a lighter center.



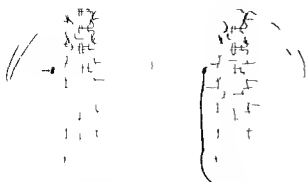


Fig. 1 (left) X-ray catheter inserted into the right ureter. The catheter is shown in the lumen of the ureter, and the shadow of the catheter is visible on the X-ray plate. The catheter is labeled 'C' and the shadow is labeled 'S'. The diagram also shows the lumbar vertebrae and the position of the catheter relative to the ureter.

# INTENSIFICATION OF WEAK SHADOWS CONSIDERATION OF VALUE OF X-RAY

When we recall the fact that a fairly large percentage of ureteral calculi are of the pure uric acid type it is easy to understand why the shadows should often be overlooked because they are so very light and hard to distinguish from the background. I can warmly recommend a method first suggested by A. D. Bevan of Chicago of studying our plates when they are perfectly dry and preferably with an opera glass which con-

centrates the view to a small field at a time and gives one a stereoscopic effect. Braasch is of the opinion that an accurate diagnosis of stone in the ureter cannot be made from roentgenographic data in more than 60 per cent of the cases. In 67 cases reported by Geraghty and Hinman<sup>1</sup> the X-ray missed a calculus in 15 or 4.4 per cent most often in the lower ureter.

A recent experience with a method first suggested by Kuenmel has led me to urge its more frequent use in cases where the presence of a calculus is suspected but the X-ray either is negative or shows a very faint shadow.

**CASE 1.** Male age 40. Four typical attacks of right ureteral colic with microscopic hematuria. The X-ray showed a faint shadow in the course of the right ureter (lumbar portion). The X-ray catheter passed and a small amount of collargol (50 per cent) as permitted to enter the ureter in the vicinity of the shadow through the catheter. A second X-ray plate now showed distinct shadow just beyond tip of X-ray catheter (Fig. 9). Removal of rough uric acid calculus from lumbar portion of the right ureter.

The plan of the Kuenmel method is to intensify the shadow by permitting some of the solution impervious to the X-ray to be deposited on the surface of the calculus thus

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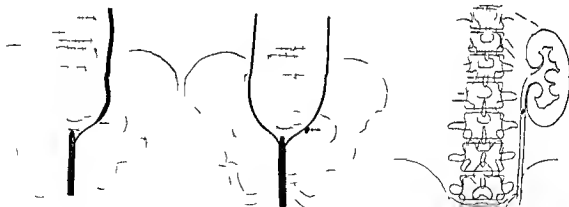


Fig. 1

Fig. 2

Fig. 3

Fig. 1. X-ray catheter inserted into the right ureter. Fig. 2. X-ray catheter withdrawn, leaving a space for collargol to be deposited. Fig. 3. X-ray plate showing the distinct shadow of the calculus after the Kuenmel method.



Fig. 9 Typical extra-ureteral shadows of calcified retroperitoneal gland in Case 7. Note dark center and light periphery of the irregular shadow.

increasing the density of the shadow. I can warmly recommend this method in doubtful cases. I have had so little personal experience with the wax-tipped catheter for the diagnosis of such difficult cases that I can only quote from the above-referred-to article of Geraghty and Hinman<sup>1</sup> and a more recent one by Hinman<sup>1</sup> in which they state that they have made a diagnosis by the use of the wax-tipped catheter in a number of cases in which the X-ray was negative, the diagnosis being confirmed in every case by the operative removal or subsequent passage of the stone.

#### VALUE OF URETEROGRAPHY AND PYELOGRAPHY IN RECOGNITION OF INTRA-URETERAL SHADOWS AND DEGREE OF OBSTRUCTION OF URETER AND SECONDARY EFFECTS ON KIDNEY

Those who have hesitated to employ this most valuable method of diagnosis on account of the early fatalities following its use are urged to renew their acquaintance with the assurance that the work of the writer



Fig. 10 Intensification of shadow in Case 9. Before the use of the X-ray catheter and collargol the shadow could hardly be seen.

has shown experimentally and its employment in thousands of cases by Briasch<sup>1</sup> and others has demonstrated that ureterography and pyelography have been placed upon a safe basis. The information obtained by this method is of especial value in the recognition of the presence of a calculus either by a localized dilatation (Fig. 12) at the point of lodgment of a calculus or by the estimate of the degree of dilatation of the ureter or renal pelvis above the calculus.

The following case will serve to show the value of the method both for diagnostic and prognostic purposes.

**CASE 10.** Male, age 33. History of repeated left ureteral colics over period of two and one-half years. X-ray showed relatively large shadow in juxtavesical (Fig. 15) portion of the ureter confirmed by introduction of X-ray catheter. Urine escaping through left ureteral catheter was very turbid and contained many pus cells. In order to confirm the fact that the shadow was due to a calculus and also to ascertain the condition of the ureter and renal pelvis above the calculus a ureteropyelogram was made. It revealed a shadow (Fig. 16) about one centimeter wide indicating a moderate degree of obstruction. The pelvic shadow confirmed this showing only a slight amount of dilatation. After a number of ineffectual attempts at nonoperative removal the calculus was removed and an operation the size of the ureter confirmed the ureterogram in

holding that the universal will is not fully by  
themselves at the will of the individual  
but in the universal, entirely clearly  
the removal of the obstacle

Increasing experience strengthens the opinion not only of myself but of many others that roentgenraphy and psychography are perfectly safe methods if the fluid is allowed to run in a continuous line and that the two applications are both made at the same time.

NECESSITY OF THE NEW EXAMINATION  
IN CASE OF TUBERCULAR INFECTION[illegible]

**intensely infiltrated that it required removal**  
**Uneventful recovery**

This case illustrates a fact which experience with a number of similar cases has taught me, namely, that an X-ray of the urinary tract should be taken as a routine measure in every case of infection of the urinary tract with the exception of those cases of pyelitis of pregnancy and puerperium where the etiology of the infection is quite evident.

## CONCLUSIONS

1. The clinical history cannot be absolutely relied upon to make a diagnosis of ureteral calculus since there are many other conditions giving rise to ureteral colic which must be excluded.

The presence of a shadow along the course of the ureter does not necessarily mean a calculus.

3. The three best method to determine whether the shadow lie within or external to the ureter are the X ray catheter ureterography and stereorontgenography. The latter named is the most reliable and should be employed if possible in every case.

## SUBDIAPHYLLIC OR PHYLLOCLADACEAE ABSCISSA

## B. MANUEL HIND MD FACS CLC

ONE of the most interesting and at the same time difficult problem in surgical diagnosis is that of the above named dangerous affection. Difficult as the diagnosis is today it was much more so years ago before the advent of such aid as isop is hematology and roentgenology. It has been my good fortune to see and examine a number of such cases in my surgical clinic at the Michael Reese Hospital and I shall bring my conclusions on these in particular two of which I shall detail here. This is a good place to generalize regarding the qualifications of the surgical specialist namely that which I have always contended the best specialist is the one who has had a general training. In no class of cases is this so apparent as in this

ch's. I mean to imply that the diagnosis calls for a good knowledge of physical diagnosis of the chest and abdomen - auscultation percussion etc.

Subphrenic peritonitis is defined as inflammation of the peritoneum limited to the under surface of the diaphragm and any of the adjacent abdominal organs. If the inflammation remains limited and life is sufficiently prolonged usually terminates in the formation of a subphrenic or subphrenic abscess. Perforating ulcers of the stomach and duodenum and abscesses of the liver are the most frequent sources.

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Fig 1 Case 1 Roentgenogram taken October 8 1915

treitise on subphrenic abscesses dividing them into twelve groups according to their locations and the organ from which they have their starting point. The diagnosis is usually difficult and Maydl recommends the exploring needle very strongly as an important diagnostic resource. Maydl has shown that out of 104 cases not operated on only 6 recovered while out of 18 cases operated on 11 per cent died.

#### DIAGNOSIS

The cardinal points in diagnosis I have found to be as follows:

- 1 Temperature ranging from subnormal to anywhere from 101 to 106 usually preceded by a chill and sweating with or without a previous history of an acute suppurative process elsewhere.

- 2 Pain in the neighborhood of the pus accumulation or it may be diffused over the entire upper abdomen increased on deep inspiration.

- 3 Tenderness may be present or absent over the affected area.

- 4 Phrenic pain supraclavicular on the affected side.

- 5 Pleurisy with effusion on the affected side easily demonstrated with the exploring needle.



Fig 2 Case 2 Roentgenogram taken November 6 1915

- 6 High leucocyte count ranging from twelve to forty thousand.

- 7 X-ray findings are those usually of an uneven level of the diaphragm on both sides in other words a marked bulging upward on the affected side with an acute costophrenic angle together with a marked shadow over the pus accumulation and a shadow distinctly less between the accumulation and the diaphragm caused by gas when the causative agent is the colon bacillus. Naturally the symptoms depend upon the localization of the abscess the possibilities as to situation being right retroperitoneal left retroperitoneal right anterior intraperitoneal left anterior intraperitoneal right posterior intraperitoneal left posterior intraperitoneal.

A valuable aid in determining the extraperitoneal location is the inflation of the colon with air.

An abscess beneath the diaphragm between it and the liver may be either intra- or extraperitoneal. I already stated it may lie to the right or to the left of the suspensory ligament of the liver. The intraperitoneal is decidedly more frequent than the extraperitoneal and the abscess is more commonly found upon the

right side. The upper and posterior surfaces of the liver are partly covered by peritoneum and partly devoid of any serous covering. The suspensory ligament forms an oblique partition dividing the liver into a larger right and a smaller left portion. An abscess which lies to the right of the falciform ligament begins generally in inflammation affecting the gall bladder, the liver, the kidney or the appendix. An abscess which lies to the left of this ligament starts in the majority of cases from a perforating ulcer of the stomach or duodenum or from inflammation in the pancreas, intestine, spleen or left kidney. The commonest source of infection is undoubtedly the appendix. In a series of 179 cases of Maydl's subphrenic abscess the alimentary canal was the starting point of the disease in 13 cases. Koerte has reported a series of 60 cases upon which he had operated 40 cases recovering. The origin of the abscess was in the appendix in 7 cases. He gives the following table:

Site	Recess	Right	Left
Appendix		8	9
Stomach	0	5	4
Duodenum		0	
Spleen		3	
Kidney	4	2	
Pleura	4	3	
Chest			0
Intestine	1	1	0
Heart	3	3	0
Pericardial bladder	2		0
Uterine	2	1	1
	6	40	0

The inflammation from the appendix may spread upward within the peritoneal cavity along the outer side of the colon or it may pass upward in the loose cellular tissue behind the colon or via the lymphatics or veins.

The diagnosis of subphrenic abscess is often difficult especially if there be no free gas within the cavity when there is serous or purulent fluid at the base of the right lung. The physical signs that may be elicited are the following. On the right side posterior there will be dullness at the base of the chest. If there be no free gas in the abscess the liver dullness will merge above into the dullness produced by the overlying pus. The upper

boundary of this dull area will be convex. The physical signs are therefore the same as in a case of abscess of the liver. When however gas is present within the abscess the signs are most characteristic. Percussion reveals three zones of different resonance, one above the other. The upper is the normal resonance of the lung. In the middle there is tympany due to the gas within the abscess. In the lower dullness due to the fluid within the abscess. This latter dullness merges into the dullness of the liver.

Abscesses on the left side coming as they do from the stomach or duodenum contain gas. The physical signs are generally as just delineated.

When pleuritic effusion is present above the subphrenic abscess four zones of varying resonance may be encountered. The upper is normal resonance, the next is a dullness due to pleuritic fluid, the next a tympany due to the gas of the abscess and the lowest a dull area due to pus in the abscess cavity. An abscess on the right side may push the liver downward. When situated on either side the bulging of the chest wall or of the anterior abdominal wall may be seen.

Regarding the use of the exploring needle I cannot emphasize too much the employment of a large caliber needle due to the thickness of the pus in many cases and the presence of a thick, tenacious layer of lymph on the upper surface of the liver.

#### OPERATION

There are four routes by which to approach an abscess of this kind: (1) by incision through the anterior abdominal wall, (2) by incision along the lower costal margin, (3) by incision through the chest wall and diaphragm, and (4) by a combination of the thoracic and abdominal incisions.

The third or transpleural operation is the one most employed. An incision five or six inches in length is made over the ninth or tenth ribs on the right side and over the seventh and eighth on the left side. The middle of the incision is at the point from which pus has been withdrawn by the exploring needle. The ribs are exposed and about 3 or 4 inches of each are excised. The

condition of the pleural cavity is then determined. If it is empty or contains only clear fluid in small quantities it must be protected from infection either by picking the wound tightly with gauze and postponing the completion of the operation for twenty-four hours or by the introduction of sutures which include the diaphragm and both layers of the pleura. After this a small amount of gauze is packed around the edges to form a barrier to prevent infection of the pleural cavity. The diaphragm is then incised, the cut edges seized with forceps and drawn forward, the cavity emptied, washed out gently and a large drainage tube inserted. Counter drains in the back may be necessary.

The histories of the cases referred to are as follows:

**CASE 1.** O. L., age 39, merchant, admitted to Michael Reese Hospital, October 10, 1915; discharged cured December 19, 1915.

**Diagnosis.** Acute gangrenous ruptured appendicitis, local peritonitis, right-sided pleurisy with effusion and subphrenic abscess.

**History.** The patient was seized with severe pain thirty-six hours before admission to the hospital, which at first was severe over the entire abdomen but within twenty-four hours became localized to the right lower quadrant. The patient had slight headache but no nausea or vomiting. His past history was negative.

**Physical examination.** The abdomen was slightly distended, symmetrical. There was marked rigidity over the right half of the abdomen. Tenderness was generalized but especially severe over the lower right quadrant. The leucocyte count was 23,300. Pains radiated to the back. No mass was palpable.

**Operation on the day of admission.** Ruptured retrocecal appendix was found and drained.

The patient did well for a number of days and then developed a temperature ranging from subnormal to 103.6 F. with pains in the right hypochondrium and supraclavicular pains on the right side. A subphrenic abscess was suspected, but aspiration revealed nothing. The X-ray findings, November 16, 1915, showed a bulging upward into the chest of the right diaphragm and an acute costophrenic angle on this side. Fluoroscopically there was slight motion of the diaphragm on this side on inspiration. The liver shadow was unusually dense.

**Urinary findings.** Urine contained albumin and acetone and an occasional red blood cell. 8 to 10 to the high power field. Few epithelial cells present. White blood count varied from 28,000 to 103,000.

Physical examination of the chest revealed fluid in the right pleural cavity which was tapped and about a quart of seropurulent fluid was withdrawn which



FIG. 3. Case 2. Roentgenogram taken February 19, 1917.

showed histologically many pus cells, epithelial cells and red blood corpuscles, streptococci, pneumococci and staphylococci. The differential count showed 79 per cent polymorphonuclears, 19 small mononuclears, 1 large mononuclear, 1 transitional.

On November 18 the ninth rib on the right side anteriorly was resected and a large subphrenic abscess was drained. Uninterrupted recovery.

**CASE 2.** M. S., age 52, a peddler, was admitted to Michael Reese Hospital, February 18, 1917.

**History.** Onset seventeen days prior to entrance to the hospital with pains in the epigastrium along the right costal arch radiating to the right shoulder. He suffered from weakness, anorexia, loss of weight, chills and fever.

On admission his temperature was 101.2 F., pulse 98, respirations 26.

**Physical examination.** An emaciated male, appearing very sick. Expansion of the right chest only fair. Dullness on percussion from the ninth to the twelfth rib. The abdomen was flat, no tenderness, no masses were palpable.

**X-ray findings.** Right diaphragm bulged high into the chest cavity, the outline was sharp indicating pressure from below and a very acute costophrenic angle was present. Fluoroscopically the excursion of the diaphragm was limited on this side.

**Laboratory findings.** Leucocyte count 21,800, urine negative.

**Diagnosis.** Subphrenic abscess.

**Operation.** Resection of the eighth and ninth ribs anteriorly, a large abscess was discovered, opened and drained.

## A NEW PROCEDURE FOR THE LOCALIZATION OF URTERAL STONE

B HERMAN L KIETSCHMIR MD I ACS C ICAGO

A I I S R H M I C H U I P by Hos I C o-L ry S g Al B Hos I  
C I M J IC p USA

ONE of the most trying problems that genito urinary surgeons and radiographer are called upon to solve is that dealing with the correct interpretation of shadows occurring within the bony pelvis. Shadows of extra ureteral origin are often confused with those produced by ureteral calculi and hence call for an accurate differentiation. The large number of the shadow due to extra ureteral shadow producing bodies and can be definitely excluded by employing the shadowgraph catheter which shows that the suspicious shadows lie far away from the shadowgraph catheter. In cases of tone in which the shadows and the catheter apparently lie side by side the diagnosis has generally been fairly easy. Attention has been called to the value of the shadowgraph catheter in the literature. In one instance, however, in which the diagnosis was based upon the fact that the shadow of the stone and the catheter were side by side

I failed to find the stone at operation and no doubt many genito urinary surgeons have had the same experience. This illustrates at least one of the limitations of the shadowgraph catheter.

In order to reduce this possible error it has been advised that stereoscopic roentgenograms be made and Braasch has strongly advocated employing ureterogram. Recently at the Presbyterian Hospital we have resorted to a new procedure which has given us such definite and unquestionable evidence that it seems to me the method should be recorded in order to stimulate others to employ it. I believe it is a decided advantage over the present methods of technique as described above.

The method was suggested to me by Mr Earl Bull radiographer at the Presbyterian Hospital to whom I wish to acknowledge my thanks for having suggested its use in the two cases about to be reported. This method is not new in radiography as it has



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Fig 4 (at left) Case 2 Calculus in right ureter  
 Fig 5 Case Double exposure In each instance the stone and the catheter lies side by side

been employed in the localization of foreign bodies in various parts of the body but as far as I am aware it has not been employed in the localization of shadows in conjunction with the employment of the shadowgraph catheter

In a case in which a diagnosis has been made of possible ureteral stone the shadowgraph catheter is passed in the usual way. An exposure is taken with the catheter in place. A second exposure is made on the same plate without changing the position of the patient or without changing the position of the tube so that one obtains a double exposure on one plate. The results obtained with this technique have been so gratifying that I wish to report the following two cases

**CASE 1** Mrs E B age 32 had pain in the right back, constipation, pain on urination, headache and loss of weight. The patient states that the present trouble began two years ago following an automobile accident. After the injury the pain was located in the back, right side and right leg. The pain in the side would come on in paroxysms. She has had three attacks in six weeks. With the attacks of pain she vomited and was constipated. The attacks of acute indigestion consisted of severe pain in the pit of the stomach, nausea and vomiting. The duration of the attacks was from three to forty eight hours.

Following the accident the patient was catheterized as a result of which she says she developed a cystitis. The attacks of pain in the right lumbar

region and right abdomen began six weeks after the accident. Painful urination has been present since the injury. Following the accident she had to be catheterized every day for two weeks.

The general physical examination was negative. The cystoscopic examination showed the presence of a mild cystitis around the internal urethral orifice.

Examination of the urine showed the presence of pus, there being 830 leucocytes per cubic millimeter. Culture showed the presence of bacillus coli.

Röntgen ray examination showed a shadow on the right side that was interpreted as being possibly due to a stone in the ureter (Fig 1).

The possibility of this shadow being a stone in the ureter was considered owing to the fact that the catheterized specimen from the right kidney showed the presence of pus and bacillus coli. It was decided to pass a shadowgraph catheter and further localize this shadow. The shadowgraph catheter was passed. The X-ray showed the shadow and the catheter lying apparently side by side (Fig 2). A double exposure however showed the shadow lying quite a distance from the catheter (Fig 3).

Because of the fact that in this double exposure a definite interval was seen between the catheter and the suspected shadow it was decided that this shadow was produced by some extra ureteral shadow producing body and that it was probably not due to a stone in the ureter.

Exploratory laparotomy by Carl B. Davis revealed the presence of infection and stones in the gall bladder for which she was operated upon with complete relief of symptoms.



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#### CONCLUSION

I This simple method has aided us in  
one instance in making an absolute dia no i  
oi stone in the ureter that was verified by  
operation In the other instance it prevented  
our operating upon a patient who did not have  
a stone in the ureter although the catheter  
and stone apparently were in the same plane

The procedure can be carried out with  
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## LOOSE BODIES IN THE ABDOMINAL CAVITY

B MAX FIMMER MD OM NEBRA A

VERY little reference is made in  
American literature to loose bodies in  
the abdominal cavity and with the  
object in view of summarizing our knowledge  
in this branch of anomalie I take the liberty  
of reporting a recent case in my own experi-  
ence and reviewing American and foreign  
literature upon the subject No detailed  
reference will be made to foreign bodies which  
is under tood to mean bodies which have been  
introduced into the abdominal cavity fr m  
adjacent viscera or from outside the body

The patient is a single girl aged twenty  
was referred to me on February 1, 1914, com-  
plaining of pain in the right lower abdomen  
Her mother had died of insanity at the age of  
39 years

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the ascending colon to the transverse colon producing an angulation at the hepatic flexure was also liberated. The omentum was congested but not adherent. During the pelvic examination a loose body was removed from the region to the right of the midline and anterior to the true pelvis. The uterus was in good position and normal. The left tube and ovary were normal to the touch. The right tube was slightly congested. The right ovary was normal. The gall bladder was small and emptied easily. The right kidney was normal in size and consistency.

The patient made an uninterrupted recovery and left the hospital on the tenth day.

The loose body which was removed was almond shaped 3 centimeters long, 1 centimeter in breadth and 1.5 centimeters in thickness. It weighed 50 grains. It was light brown in color and covered with a grayish secretion. There was no evidence of a vestigial pedicle or adhesion. On one side was a calcified plaque occupying about one third of the surface. The consistency was rather firm.

The body cut with a grating sensation and revealed a distinct capsule about 1 millimeter thick enclosing a finely granular material of a yellowish brown color. Interspersed in this were several small particles of a hard colorless material. No definite nucleus was seen. The contents of the capsule gave a very strong positive guaiac test for blood. Under the microscope it was seen to be composed of fat droplets, crystals and blood corpuscles. The specimen was submitted to a competent pathologist for detailed examination. His report threw no more light upon the origin of the body as the capsule was in such a state of disintegration as to prevent a diagnosis of the tissue. He reported unknown crystals in the contents of the capsule.

From the gross examination of the body we are justified in drawing the following conclusions:

1. It had been a viable body covered by a definite capsule and containing fat.
2. During its period of viability there had been an impairment in the circulation as evidenced by the calcification in the wall.
3. At some time there had been an injury or strangulation which had produced a dissemination of blood throughout the interior of the body.
4. The body had been separated from its blood supply for some time because of the disintegration of the capsule.

I have been able to find in literature the description of seven bodies which were similar in many respects to the one just described. The body reported by Ogle (4) was lodged in a depression on the upper surface

of the right lobe of the liver and fell out during the examination of the abdominal viscera. It had evidently been held in position by the pressure of the diaphragm. There was no evidence that it took its origin from the liver. A similar body described by Van der Byl (5) was found lying below the posterior thick border of the liver. At one point the surface of the body was abraded as if a slight adhesion had existed. The body described by Wilks (7) showed an attachment to one side of a filament of cellular tissue about one inch long whose other end was free.

The specimen reported by Murchinson (10) also showed the presence of filamentous shreds on one spot. Hektoen (14) found two bodies in depressions on the summit of the diaphragmatic surface of the right lobe of the liver, one of which was connected to the margin of the depression by a thin fibrous band. Both bodies were found in cadavers of males over forty years of age. Another body of similar character but not free was found by Arthur Meyer (17) within a small sac twice its size on the intestinal surface of the ventral wall of the great omentum. Van der Byl (8) reported the finding in the abdominal cavity of a female of another body similar to the one previously described by him.

These seven free bodies and the encysted body are similar in the following respects: (1) The capsule consists of a fibrous like tissue varying in consistency from fibroid to semi cartilaginous. (2) The contents of the capsule consist largely of fat in varying degrees of liquefaction. Three of these bodies showed remnants of a pre-existing pedicle or attachment. One of these was found in a depression on the surface of the liver, one in the hernia sac and one on the left side of the abdominal cavity. Three bodies were found in depressions on the surface of the liver showing the tendency for the small body to be held between the diaphragm and the liver and the ability of the liver to adjust itself to the presence of the body without evident injury to the liver. The only change was a thickening of the capsule of the liver which formed the floor of the depression.

These seven bodies are so similar in structure that it is justifiable to suppose that they

had a similar origin. Undoubtedly following their detachment from the parent tissue they all had vestiges of a pre-existing pedicle or attachment. In four of the bodies these vestiges had been completely removed probably by the mechanical action of the body rolling around among the loops of intestines.

There is another class or group of bodies found in the abdominal cavity, a typical example of which was removed from a hernia sac at operation by Shaw (3) whose classical description I shall quote verbatim:

The following is a description of the specimen: It was a small, white, firm, oval body, the size of a pea, with a smooth surface, and a pedicle attached to one end. The pedicle was about the size of a pin, and was composed of a dense, fibrous tissue. The body itself was composed of a dense, fibrous tissue, and was covered by a thin, transparent membrane. The body was found in the abdominal cavity, and was attached to the wall of the hernia sac. The body was removed by a simple incision, and was found to be a fibrous concretion, the result of a blood clot. This early view was accepted by Hunter and Lavey, Laennec and Bechard, Andral and Lebert, believed the formation took place under or outside the serosa, a pedicle formed and the pedicle ruptured. Therefore it was their theory that all of these bodies had a peritoneal coat. Cruveilhier considered them productions born on the surface of the spleen, which had become detached. Bouillard thought that they were analogous to vesical stones.

It remained for John Reid in 1836 definitely to consider the appendices epiploicae as the probable origin of these bodies. Since that time this view has been generally accepted by the English and French schools, and evidence has accumulated to substantiate this early view. Wilks (7) reported the discovery of a body the size of a large pea in an appendix epiploica which seemed to grow from the side of that structure. This body was similar in morphology to the one described by Shaw. He called attention to two specimens in Guy's Hospital Museum, one showing a bifurcated appendix twisted on its pedicle so as to appear strangulated, the body appearing not much changed, and another showing a further stage in that its attachment to the intestine consisted of a mere filament. Van der Byl (8) also reported altered appendices attached to the sigmoid and transverse colon, one of which was very firm and presented a semi-cartilaginous consistency, while the other was dark colored and apparently contained blood.

Another source of origin of these bodies is the great omentum. Henry Thompson reporting a case for Nesbitt (9) stated that prior to operation for a strangulated hernia they could feel a hard mass in the hernia sac and upon opening the sac they found a rounded body the size of a nut attached by a very small pedicle to the omentum which also formed a part of the hernia. On section this pedicle was found to be continuous with the adipose tissue which constituted the principal bulk of the body. At the edge of this fat was a hard calcareous crust investing which was a dense capsule cutting as does cartilage. This capsule under the microscope was of a lamellated homogeneous character.

Another report substantiating the omental origin is the case of Hoche (15) in which he found not only a free body but several fatty lobules which were attached to the great omentum by fibrovascular pedicles. These lobules were one and one half centimeters in diameter.

The formation of these loose bodies is comparatively clear up to a certain point. We can easily imagine that these pedunculated appendices epiploicæ or lobules of fat might become twisted upon their pedicles. A partial torsion would interfere with the blood supply and promote calcareous infiltration. The increasing weight of the body and necrosis of the pedicle would eventually result in a detachment from the parent tissue and a loose body would be present in the abdominal cavity. The similarity between this hypothetical body and the class of bodies first described is obvious. I do not think it is presumptuous to claim that the nucleus of the second class of bodies is similar to the hypothetical body.

The formation of the lamellated fibrous shell of the second class of bodies offers abundant opportunity for speculation. Shaw (3) thought that the surface of the free body became coated with minute particles of fibrin derived from the serum of the peritoneal cavity; that this process if continued long enough would result in the formation of delicate fibrinous lamellæ arranged in concentric order and thus all appearance exhibited in the specimen would in time be presented. John Reid (6) considered it as a mechanical deposition of coagulated albumin and stated that the concentric layers of aneurismal coagula and the so called deposits on the valves of the heart were of the same character. He called attention to the coagulating action of albumin on fat as first shown by Acherson to support his contention. Arthur Meyer (17) denies the possibility of growth of loose bodies after detachment.

The detailed examination of the body found by Hoche (15) and his masterly presentation of this subject offers the most scientific and logical explanation for the growth of these bodies after detachment. Upon examination of the dissociated lamella he found that they

clearly gave the reaction for fibrous tissue. In the interstices of these fibers he found fusiform cells similar to those in the tissue of the conjunctiva. Toward the periphery these cells were more apparent, the nucleus less thin and flat and the protoplasm more visible. Some cells near the surface were distinguished being surrounded by fine granulations or light homogeneous fibrillar substance which might be fibrous transformation. He believes that the capsule is formed by the free collagenous cells of the peritoneal cavity which successively deposit themselves upon the surface of the free body and secrete the fibers or fibrils that they derive their nutrition by imbibition from the serous environment. As these cells are separated from the periphery by successive deposition of other cells they lose little by little their means of nourishment and undergo a granulo fatty degeneration of protoplasm and granulation of the nucleus.

One interesting fact remains to be noted namely, it is not necessary for the body to be free in the abdominal cavity in order to acquire this fibrous capsule. This dictum is supported by the case of Nesbitt (9) which had the characteristics of the body described by Shaw but was attached to the omentum by a definite pedicle.

As a clinical entity little can be said concerning these loose bodies. The majority of them have been found at autopsy or when operating for other causes. It is very questionable whether or not they produce symptoms after detachment. In the case reported by Campbell and Owen the patient had felt a mass in his abdomen for twenty five years. For forty years he had suffered from digestive disturbances as burning sensation in the stomach after eating distention and discomfort from gas and from constipation. However these symptoms could not be attributed to the loose body alone because of the other pathological conditions revealed at autopsy. The majority of these bodies have been removed from men over sixty years of age. The youngest patient prior to my case was thirty years old. The condition is more prevalent in men than in women.

These two groups of bodies constitute the majority of loose bodies found in the abdom-

inal cavity. However bodies of entirely different origin have been found as illustrated by the following case reports.

Simonin (1) reported the finding of two small loose bodies in the abdominal cavity of a cadaver which were the size and shape of two small horn or cucumbers. They were formed of a cartilaginous and bony tissue contained in a membrane absolutely free in the pelvis and floating to the right of the bladder and rectum. They were greenish brown in color and weighed 38 grains. In dimension they were two inches long and six lines broad at the center. He considered them to be vegetations of the peritoneum.

Kachewirawa (14) described an interesting body found at operation in the abdominal cavity of a woman. It was the size of a small egg and was invested by a complete membrane. Under the first layers of the body was a thick crust. In the center was a small cavity containing a worm like mass with no regular structure but under the microscope embryonic tissue of the heart lungs brain liver and muscle were recognized. She considered this body to be the product of an extra uterine pregnancy.

Reindfleisch (15) found in the right iliac fossa of a female cadaver a free hard body the size and shape of a goose egg with a smooth surface of yellowish color. Microscopic examination proved it to be a typical fibromyoma. Heid reported a free fibroid in the abdominal cavity with a similar tumor attached to the uterus.

Sperling and H. Stein found at operation at the Koenigsberg clinic a free body the size of a child's head which proved to be a fibromyoma with retrogressive transformation. There was evidence of a pre existing chronic peritonitis and adhesions.

Pokitsansky reported a case in which a tube and ovary were free in the abdominal cavity. A similar case was reported recently in this country by DuBose (19). Turner reported a case with an ovary and uterine fibroma free. Lobstein found a dermoid cyst free in the abdominal cavity.

Several classifications of loose bodies based upon possible origins have been suggested but a they are not substantiated by fact or

case reports I shall not include them in this review.

In conclusion I would call attention to the fact that while any pedunculated mass in the abdominal cavity may become detached and form a loose body it is a comparatively rare condition and that the majority of these loose bodies have had their primary origin from the colon or great omentum.

I append hereto a resume of observations collected by Vercoutre which consisted of 28 observations of probable epiploic origin reported between the years 1703 and 1871. To these Hoche added 5 cases which he had found in literature. To this resume I wish to add the cases reported by Ogle (4), Murchinson (10), Hektoen (14), Berge and Gutman (16) and Campbell and Owen (18).

#### RESUME OF FORMER OBSERVATIONS OF LOOSE BODIES IN THE ABDOMINAL CAVITY WHICH PROBABLY HAD THEIR ORIGIN IN THE COLON OR GREAT OMENTUM

Reported by L. t. n. 173. a smooth hte body  
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f. d. t. ty. v. f. g. Th. b. d.  
f. l. f. t. t. f. l. d. t. y. d. h.  
f. hm. Th. l. t. t. l. k. tru. tu. th.  
f. l. b. t. Th. l. l. f. a. h. t. l. d.  
g. d. t. f. y. 90. M. y. b. i. f.  
3. k. n. t. l. b. y. l. f. f. h. h. d. p. d. l.  
4. k. p. o. l. d. b. p. h. l. 90. f. body. th. f.  
l. l. th. le. th. f. p. e. f. b. rt. l. ag.  
l. l. v. J. h. l. d. 936. M. v. f.  
f. l. th. pel. e. p. e. t. m. f. mal. hty. y. rs. of.  
f. l. O. l. b. l. l. b. l. d. d. d. f.  
gl. l. g. l. a. e. l. t. h. d. th. st. y. f.  
ll. m. l. l. f. h. p. le. f. b. rt. g. f.  
Th. l. l. d. d. d. th. m. det. h. d. pp. d. c. s.  
J. l. l. p. t. l. l. D. ll. f. C. l. f. h. f. d. y. a.  
p. l. b. d. th. f. b. l. d. b. l. f. d. y. the  
p. l. m. 845. T. l. m. ll. pell. l.  
f. R. p. l. l. b. L. f. d. m. g. th. l. t. f.  
f. m. l. m. l. l. g. c. p. s. t. Tl. b. d. Th.  
f. l. b. l. f. g. c. p. t. cy. d. l. f. t.  
8. l. l. m. l. th. p. l. t. l. f. d. h. l. body.  
f. d. th. l. l. l. L. l. nl. 840. h. d. l. t.  
f. g. J. p. l. l. b. C. l. l. 85. h. l. l. t.  
b. h. y. ll. b. ly. f. d. h. d. f. by.  
l. m. n. Th. l. d. y. h. d. p. l. d. f. fi.  
/ m. Th. l. m. l. Th. p. l. d. f. th. f. th.  
p. p. l. l. m. ll. e. l. h. mp. d. f. th. f. th.

entire thickness of the body. The nucleus was a fatty mass the size of a marble.

10 Reported by Canton in 1851. An oval white body of resistant consistency was found in the peritoneum. The body was 4 by 3 cm in size. The capsule consisted of concentric layers of fibrous tissue. The nucleus was a hard cartilaginous mass the size of a hazelnut.

11 Reported by Deille in 1851. From the body of a male aged thirty years were removed 5 almond shaped bodies the size of a chestnut. The capsule was an imbricated opaque broad structure and the nucleus was fatty. There was evidence of a previous chronic peritonitis. The bodies were found in the peritoneal cavity.

12 Reported by Balth in 1851. Many bodies some the size of a hazelnut were found in the peritoneum of a woman. Some were free others hang from the peritoneum. The surface was cartilaginous underneath the thinness was fibrous. The nucleus was calcareous.

13 Reported by Lebret in 1851. A body near the hepatic peritoneum. The capsule consisted of concentric fibers and the nucleus was calcareous. There was evidence of a cystic pedicle.

14 Reported by Leconte in 1853. A body the size of a small billiard ball, eight to five grains and 4 cm in diameter was found in the retroperitoneal sac of a man sixty-seven years old. The body was spherical and glistening, being so smooth as a serous surface. The capsule was dull gray in color and consisted of concentric layers. The nucleus was small and calcareous and was composed of carbonate and phosphate of lime.

15 Reported by Deille in 1854. A body the size of an almond with an imbricated covering and a fatty nucleus.

16 Reported by Shaw in 1854. An oval body of solid consistency as found in a hernia sac of a man aged 62. It was as large as a pigeon's egg, being 1 1/2 by 1 inches in diameter. The capsule was fibrocartilaginous and the nucleus of a cretaceous fatty material. He considered it a product from an appendiceal epiploceae.

17 Reported by Ogilvie in 1855. A body the size of an almond found on the surface of the liver. It was of a pearly white color and had the consistency of cartilage. The capsule was 1/2 of an inch thick and the nucleus was composed of a friable yellow material. Shreds of fibrous tissue were present on the surface.

18 Reported by Gouboux and Poin in 1856. A body of hard consistency with the appearance of a lipoma in a horse. The external capsule was of cellular tissue the nucleus was fatty. A pedicle 0.4 cm in length.

19 Reported by Van der Byl in 1857. A body about 1/2 inch long was found in the pelvis of a woman. The surface was smooth and shiny. The nucleus was of a pulpy yellow material with gritty particles. Trace of a pedicle. Origin thought to be appendiceal epiploceae.

20 Reported by Van der Byl in 1857. Two bodies 3/4 of an inch long in a man attached to the transverse colon were of hard cartilaginous consistency one hanging from a broad pedicle. Pedicles were very fragile. Origin thought to be appendiceal epiploceae.

21 Reported by Brown and White in 1857. In the peritoneal cavity on the left side found a body the size of a bean. The capsule was fibrous and 1/2 of an inch in thickness. The nucleus was composed of a soft yellow fatty and acellular material. A filament of cellular tissue on the surface. Origin thought to be the appendiceal epiploceae.

22 Reported by Pons in 1857. A body the size of an almond with a smooth surface was found in the peritoneal cavity of a man.

23 Reported by Brown and White in 1857. An oval

hard body the size of a large pea was found in an appendiceal epiploceae attached to the intestine. The capsule was composed of numerous fibrous layers. The nucleus was yellow with a calcareous shell. Peritoneal pedicle.

24 Reported by Michel in 1859. Two bodies one the size of a hazelnut and the other as large as a marble were found in depressions on the psoas muscle. They were of bony hardness with a smooth surface. One had a very long pedicle.

25 Reported by Virchow in 1862. An ovoid body the size of an almond found in the abdominal cavity. It had a cartilaginous consistency. The capsule was composed of concentric lamellae and the nucleus was stony in appearance.

26 Reported by Virchow in 1862. Found in the abdominal cavity a loose body with a dense capsule and fatty nucleus.

27 Reported by Murchison in 1864. A smooth white body the size of an egg was found in the hernia sac of a male aged sixty years. It had a imbricated capsule and a nucleus of fat.

28 Reported by Blandin in 1869. A body which he stated as analogous to that reported by Shaw (See No 16).

29 Reported by Greenhow in 1871. Three bodies near the cardiac end of the stomach in the body of a female. One was larger than a hen's egg the other two being much smaller ovoid in shape with a smooth glistening surface of dirty color. The capsules consisted of concentric lamellae formed by parallel fibers. The nucleus was small and calcareous.

30 Reported by Wood in 1872. A body found in a hernia sac which he reduced into the abdominal cavity.

31 Reported by Demanin in 1889. A body as large as an almond found in the Douglas pouch. It was smooth and soft and of a bluish white color. The capsule was erythroid and was formed of connective tissue. The nucleus was composed of fatty material and epithelial debris.

32 Reported by Sottas in 1891. A body as large as a hen's egg as found in the cul-de-sac of a man aged sixty years. It was of elastic fibrous consistency with a smooth glaucous surface of bluish color. The capsule as formed of regular concentric layers of very hard fibrous tissue. The nucleus was the size of a pea and very hard.

33 Reported by Ilketo in 1890. Two bodies of grayish color were found on the surface of the liver in a man aged forty years. They were 1 1/2 cm by 3 mm in diameter and quite firm in consistency. The capsules were semi cartilaginous and the nucleus of a yellowish granular material. Fibrous bands were attached to them. Origin thought to be appendiceal epiploceae.

34 Reported by Monnier in 1891. A body the size of a kidney bean 3 by 2 cm by 5 mm in dimensions and of a hard uniform consistency. The capsule consisted of concentric lamellae and the nucleus was of a yellowish material with a bluish gray elastic capsule or shell.

35 Reported by Letenneur in 1891. A body the size of a nut was found among the intestinal loops in a man aged sixty years.

36 Reported by Ilketo in 1910. A body the size of a hen's egg 1 1/2 by 55 mm was found in the pelvis of a man aged seventy-seven years. It had the appearance of a hard boiled egg with the shell removed being bluish white in color. It was firm in consistency a little elastic. The capsule was composed of concentric lamellae. The nucleus was small and yellowish in color and composed of cholesterol crystals and fat. There was a trace of a pre-exstinguished pedicle. Origin thought to be the appendiceal epiploceae.

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5 V N DER BYL T P th S c L d 855 1  
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 7 W L S T P th S l o d 87 4  
 8 V N DL BYL T Path S c Lo d 87 126  
 9 Tio rs v H T P th So L d 86 89  
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 3 I F L CH A ch f path A t 899  
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A STUDY OF THE DEVELOPMENT OF THE EPIPHYSIS<sup>1</sup>

BIBLIE H KITSCHIK M.D. CHICAGO

HOW frequently we make errors in the diagnosis of fractures about the joint in the young. We forget that there are various centers of ossification and various stages of development in the epiphyses of the long bones of children and adolescents. The X-ray misleads us frequently in the fractures and dislocation around the elbow, knee and hip joint that I deemed it advisable to make a very thorough study of the normal condition which exist in children and young adults. We have occasionally found ourselves attempting to nail or suture an epiphysis to the shaft of the bone which normally does not completely ossify until the eighteenth or twentieth year. On the other hand we ignore important anatomic structures because the ossification is shown in the X-ray plate as a very small and insignificant looking body. I will present illustrations which seemingly show fractures through the olecranon and os calcis but which are in reality not fracture at all.

It is most important that we should be able to distinguish between the normal and abnormal roentgenograms of a child's joint. In the very early periods of bone development the epiphysis is entirely cartilaginous. With the appearance of the center of ossification

there is a gradual disappearance of the cartilage until only a shell remains surrounding the cancellous epiphyseal bone and marrow. The cartilage at one end persists to form the articular cartilage while at the inner boundary it forms a part of the epiphyseal cartilage line. This part of the epiphyseal line toward the epiphysis is designated as the epiphyseal ossifying cartilaginous layer. It consists of hyaline cartilage with irregularly scattered nuclei and from its epiphyseal side osseous buds of cartilage extend into the epiphysis. In the older animal the part of the shell of cartilage connecting the articular with the epiphyseal cartilage line undergoes complete ossification so that the articular cartilage is no longer found to be inserted into the epiphyseal line. The remainder of the epiphyseal cartilage line is composed of columns of cartilage cells the nuclei of which are flat and heavily stained near the epiphyseal ossifying cartilage layer but gradually become round and larger on nearing the metaphysis until they are finally of a vesicular structure with a surrounding light staining protoplasm. These large vesicular cells form the boundary between the epiphysis and the metaphysis and finally become a part of the latter. It is by the proliferation of the cartilage cell of

the epiphyseal cartilage line that the longitudinal growth of bone is maintained

Because of this complex form of development it has been found impossible to transplant the epiphyseal line Haas and von Tappeiner have made some very interesting experiments of reimplantation and homoplastic transplantation of the epiphyseal line They both concluded that the epiphyseal cartilage line ceases to functionate either when transplanted by itself or with a small or large piece of adjoining bone or even when transplanted as an entire intact bone The first change after transplantation consists of a fragmentation of the cartilage columns near the epiphyseal ossifying layer Then there is a fibrous substitution of the remaining parts and finally complete ossification occurs The only evidence of regeneration is near the periphery between the perichondrium which part seems to retain its property of producing cartilage This new cartilage possesses none of the length producing functions of the normal epiphyseal line Haas believes that the loss of growth from the epiphysis is due to interference with the vascular supply from the diaphysis to the epiphyseal cartilage line

In order to get a better understanding of the development and growth of bone let us consider the roentgenograms of a newborn fully developed infant (Fig. 1) A center of ossification in the distal epiphysis of the femur is so constant in the newborn that Lambert calls it a sign of maturity Swengel found it to appear between birth and the third year Hartmann found it lacking in 12 per cent of cases at birth

The four parts of the occipital bone are separated from each other by thin layers of cartilage the mastoid portion of the temporal bone is not ossified in its entire extent the lateral halves of the frontal bone are still separated The vertebrae are ossified in all their essential parts but the centers of ossification are separated from each other by cartilage (Fig. 2) In some cases the proximal epiphysis of the humerus is ossified but the ossification of the greater and lesser tuberosity comes later At the lower end of the humerus the ossification centers are not present at birth the one for the external

condyle coming between the thirteenth and fourteenth year and the center for the external epicondyle between the eighth and tenth year The internal condyle develops from the fifth to the sixth year and the internal epicondyle at the eighth or tenth year I mention these especially because they are so frequently involved in fractures about the elbow joint in children In the hand all bones are ossified at birth except the carpus in which the centers of ossification in the os magnum and unciform may be seen very rarely The cuneiform is seen at third trapezium and semilunar at the fifth year scaphoid at sixth trapezoid in eighth pisiform at twelfth year The ossified portion of the os pubis usually surrounds only a portion of the anterior boundary of the obturator foramen while the region of the symphysis and upper margin of the horizontal ramus of the os pubis remain cartilaginous

No ossification centers are present at birth in the upper end of the femur the one for the head coming during the first year for the greater trochanter about the third year and for the lesser trochanter from the thirteenth to the fourteenth year The centers for the proximal epiphysis of the tibia and fibula and those for the metatarsal bones such as the cuboid and the three cuneiform bones are usually not present at birth The os calcis develops by a single center which appears about the sixth month of fetal life but the ossific center for the epiphysis of the os calcis appears only at the ninth year The astragalus appears at seventh month the cuboid at ninth month external cuneiform first year internal cuneiform third year mid cuneiform and scaphoid at fourth year

In describing the variations in the epiphyseal development Hess states that the growth and development is influenced largely by pathologic conditions of the mother and the fœtus such as syphilis rickets osteogenesis imperfecta etc These same lesions will of course retard or change the development after birth as well as before

The roentgenogram presented shows the development at birth The technique for the production of this representation was worked out by Julius Hess of Chicago



Thus having a good working knowledge of the appearance of the normal human skeleton at birth let us turn our attention to the subsequent developments of joints which most interest the surgeons. I have mentioned the time of development for the ossific centers at the lower end of the humerus the proximal end of the femur and the changes as they occur at the ankle joint.

The lesion which most interest us are first fracture and dislocation second inflammatory lesion third change due to direct trauma and fourth abnormal development caused by nutritional disturbances principally rickets.

The first case which attracted my attention was one of congenital hip dislocation in which I had attempted to make a bloodless reduction. The roentgenogram which was made after this futile attempt led me to believe that a portion of the head of the femur had been torn away and displaced alongside of the neck. An open operation was performed and we found that the head of the femur had not been injured in fact was quite normal except for the marked flattening on the one side where it had rested against the ilium above the acetabulum. We did find however that the entire greater trochanter with its center of ossification had separated and lay along side of the neck.

Metcalf reported a separation of the epiphysis of the small trochanter of the femur following a direct injury. Aside from the positive diagnostic evidence of the X ray he mentions clinical symptoms such as localized pain and tenderness inability to flex the thigh or Ludloff's sign which is a localized swelling or ecchymosis in the upper part of Scarpa's triangle.

In the adolescent coxa vara which was thought to have been due entirely to rachitic changes Steindler in a very able article seems to prove that all of these cases are primarily separation of the epiphyses at least as far as the coxa vara capitalis is concerned.

I will show you the roentgenogram of a case of traumatic separation of the lower end of the epiphysis in a boy aged 14. In this case the trauma was a direct one and so violent that a

fracture extended up into the femur (Fig 9). MacAusland Dumarest Binney and others have reported such separations. Tanton reported a very rare injury that of a traumatic separation of the superior epiphysis of the tibia. One case of separation of the lower epiphysis of the humerus with rupture of the brachial artery was published in the report of St Bartholomew's Hospital London. Neuhoff speaks of a traumatic intra acetabular separation of the pelvic bones and calls it an epiphyseal diastases in the acetabulum. Kellogg Speed reported a very interesting case of an epiphyseal fracture of the lower end of the radius which he differentiates definitely from a true Colles fracture.

After diagnosis of epiphyseal separation has been made it is quite necessary that complete reduction be made at once. In these cases as in ordinary cases of fracture exudation of blood occurs between fragments not widely separated which exudation if followed by an infiltration of round cells and later organization might result in the obliteration of the growing function of the epiphysis and finally give a short bone. I remember having seen one such case in which the internal malleolus was involved. A fracture at the junction of the malleolus with the shaft occurred in a patient at the age of 14. The internal malleolus remained very much shorter and a marked incapacitating inversion deformity of the foot resulted.

There has been some speculation with reference to the retardation and stimulation of the growth of bone. Stryer reported a case in which he believed that a slight trauma to the upper epiphysis of the femur aided probably by the hyperemia of the leg produced by the rather snug bandage had markedly stimulated the growth of the extremity. Meisenbach states that the growth of the epiphysis can be influenced by chemical means and that a chemical stimulation of bone can be brought about by the injection of formalin and glycenn.

A very frequent site of inflammatory changes at the epiphysis is at the upper end of the tibia where the epiphysis is seen to have a tongue like projection extending down the front of the bone to the tubercle of the



Fig. 7. Shows a fully developed infant at birth with the absence of a patella.

tibia (Fig. 8). Here we frequently see the typical Schiatter's disease which is also known as epiphysitis tibia (Fig. 8). In these cases we have that peculiar worm eaten appearance at the epiphyseal line which begins near the tip of the tubercle and extends upward and backward. Clinically the pain, tenderness and swelling over the tibial tubercle may or may not be due to a trauma. A thorough knowledge of the normal picture is necessary to distinguish between the starting of the epiphysis as described by Scudder in his latest work on fractures and fractures or avulsions at that point. From an examination of a large number of plates it was found that there was a separate ossification center in

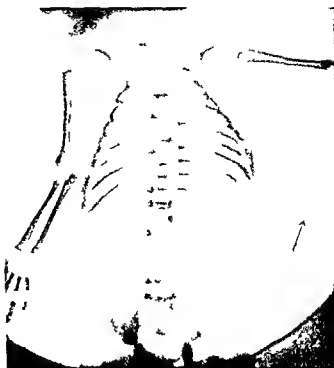


Fig. 14. The skeleton at birth showing the detached skull with its articular surface of ossification. Note the distinct separation of the articular surface.

no child under ten which would mean then that Schiatter's disease does not develop



Fig. 13. Showing development of knee and elbow joints (at age 4). Note the center for the patella also for the upper end of the radius and ulna. The epiphyseal line for the femur and tibia are plainly marked.



Fig. 5. Roe. The knee joint after the removal of the femoral head and neck, showing the normal position of the tibia and patella.

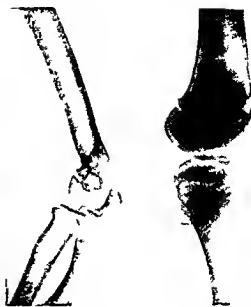


Fig. 6. Roe. The knee joint after the removal of the femoral head and neck, showing the normal position of the tibia and patella.

until after the tenth or eleventh year. A similar condition with the same symptom of inflammation is found in the hip, known as Perthes' disease. Naturally the condition in the hip is more serious on account of the larger epiphysis and greater function of that part.

The deformities which follow injuries to the epiphyseal line are not rare. We have those due secondarily to osteomyelitis or tuberculosis but probably more frequently to a direct interference with a portion of the epiphyseal

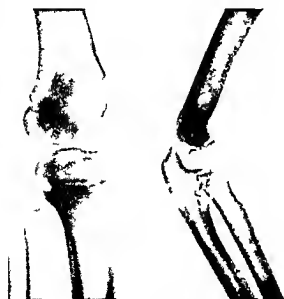


Fig. 7. Roe. The knee joint after the removal of the femoral head and neck, showing the normal position of the tibia and patella.



Fig. 8. Roe. The knee joint after the removal of the femoral head and neck, showing the normal position of the tibia and patella.



Fig. 8. At age of 1, showing normal knee to the right and at the same age a Schläter's disease to the left.

line. I shall never forget the case of extreme deformity at the knee joint which I saw when I was in interne. This deformity was due to the fact that the epiphyseal line on the inner aspect of the femur was destroyed during an



Fig. 9. Showing an epiphyseal fracture and fracture ten long at the femur.



Fig. 10. Showing rachitic deformity at the age of 5. The epiphyseal line on one side continues to grow, while on the other side the growth is retarded.

operation for osteomyelitis in the lower portion of the shaft. What resulted? The inner head or condyle of the femur ceased growing while the outer half continued its growth with a resultant incapacitating bowing of the knee.

Sever reports a case of apparent idiopathic obliteration of the epiphyseal line accompanied by a marked overgrowth of the external condyle in the lower end of the femur in a child of 8.

We have all seen the deformities which take place at the epiphyseal line in the nutritional disturbances, especially those of rickets. In these it would seem that a portion of the epiphyseal line retards its activities

while the remainder continue or increases in it bone production (Fig 10) In these cases however the epiphyseal line is not destroyed as under proper treatment and forcible correction most of them recover entirely without deformity

CONCLUSIONS

In conclusion permit me to emphasize  
1 That a thorough knowledge of the normal structure and their time of appear

ance is necessary intelligently to treat the abnormal conditions

That fractures at the epiphyseal line should be recognized early and reduced completely to avoid deformities

3 That injuries about the joints in the young must never be treated lightly and haphazardly

4 That operative injury of the epiphyseal line is inexcusable with our present knowledge of its importance

ANALYSIS OF THE WORK OF THE UTEROLOGIST

By ROBERTA DICKINSON, M.D., F.A.C.S.

THIS Society might with propriety make a survey of the joint peculialie of which it is the national representative But betterments are needed which only wide and extensive study can bring about Before we can formulate standards we must get the data together Other craft have shown us how to select the best in technical dexterity and other organization have indicated how our institutional service should be taken apart to be reassembled and refashioned We have not profited We hardly have such things as a standard in traction in pecton

If this seem an extreme indictment let any statistician ask whether we have agreed on the names of disease or of operation or a modern machine shop operator in injury concerning the determination of the best material to be used for or the form of the commonest instrument or the trained bricklayer about our study of the wildest motions a man twining a knot or the chemist or printer as to our symbols and abbreviations or any corporation head as to how we chart our personnel Whether it be nomenclature procedure tool transmission of skill professional organization — of all alike it is true

that no general analysis has been made and none of the agreement reached which are common to other industries

We have no real instruction in hospital procedure — such a shop are used to — no written practice in general nor card for each procedure We instructs the new visiting surgeon in all his duties Who drill the new medical assistant in technique What full and authoritative book of method is accessible to the new intern the new head nurse in the operating room or to any other recently required member of the staff

We have no real inspection What chief goes regularly into his dispensary Who check up the visiting surgeon or physician? What local or state or national medical society or municipal or state representative visits your hospital and mine to report upon our technique our equipment our staff our result

We have no wide view of our work plotted charted defined by its character and worked out in detail by function and regrouped according to the best practice of the new scientific method The four principles — standard in traction in pecton and functional management — have reached most of the other field covering as large a ground as ours Why not the health industry?

Graphic representation To the statistician figure may make mental picture but most

R l b f Am C l l l b h j  
l h b f m m l h l mb f ex l j  
f h b p m h h h h h b b d j m k l h h l j  
A R l b h h d Y T l h l d l m k l h h  
pe f r l G h j  
m h h

CHART 1 — LACK OF ORGANIZATION — USUAL TYPE OF GENERAL HOSPITAL

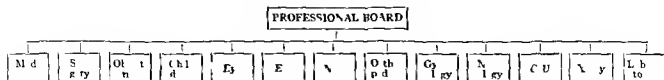
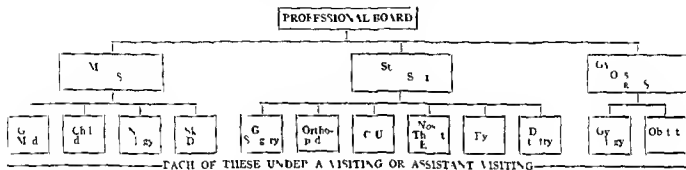


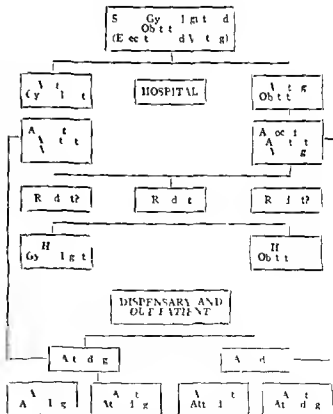
CHART — ORGANIZATION BY LARGE GROUPS



of us need something simpler. A temperature charted means more at a glance than considerable study of the digits written down in columns can convey. We make little use of those graphic representations that fix facts and show the peak and valley of our activities. Without experimenting I do not see how we can determine which of the graphic methods of depicting what our department is doing can be of real service and repay the labor required. Therefore I submit to you some of the things that seem most worth while and some that are merely of passing or local interest.

*Charts of personnel and organization.* Take the simplest consideration of organization. In a given general hospital what relation exists between gynecology and the rest of the specialties? Is it as in many general hospitals one of the thirteen or fifteen services of equal rank, very loosely related and reporting only to the medical board? Is it a group of volunteer workers which has no real responsibility to anybody and is subject to no inspection? Chart 1 shows the customary lack of organization in the usual hospital of 300 beds. Chart 2 shows the hospital in which three main departments group within them self all the specialties. The surgical specialties are classed as surgery, the medical specialties as medicine, while delivery and diseases of women stand in one department. Thus

CHART 3 — GYNECOLOGY — OBSTETRICS



the heads of the three departments form a natural executive body for the various interests which are intimately related in actuality and yet most loosely in our ordinary hospital management.



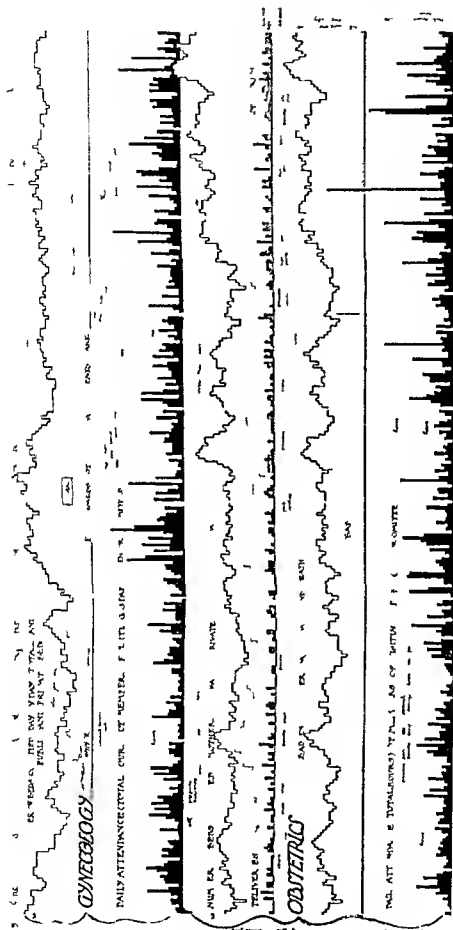


Chart 5: A call study of 100 patients by attending 9 months labor deaths



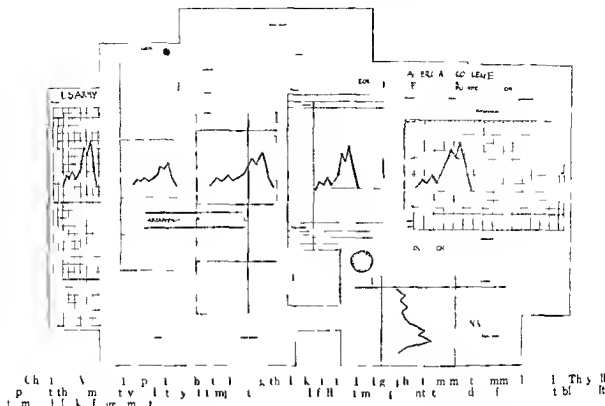


Chart 3 shows a completed organization in which the dispenser is integrated as it should be. That is the older member in the dispenser have responsible junior position in the hospital and the dispenser is under the control of one of the men who is on the hospital staff. The upright lines show just how the delegated authority runs. In another chart posted in the headquarters of the department the upper men can always have before them the names of the very newest acquisitions to the bottom of the staff. In still another chart not only are the steps of promotion shown but the area of direction of each individual his duties and his term of service. In this way your organization and mine may be compared with no undue labor.

**Charts of results.** Do the suppurations run mostly against a particular man, taking of course those in clean case — or do they begin at a certain month when the new head nurse came into the operating room or do they occur when the crew in the operating room changed in the process of training the nurses? Does our department run a larger series of

suppurations than other surgical department in the same operating suite. Does our department run a worse mortality and morbidity record than your when both are entered after the same manner. A glance at the chart answers the question.

It is easy also for the use of symbol to make public several other things. Does the Head really inspect. Just how often does he go into his dispenser and his laboratory? Does he hold a seminar regularly. How often and how long are his grand rounds. A symbol for each of these could be entered with very little expenditure of time. These are examples of conspicuous receivable information.

**Charts of the unchartable.** It goes without saying that there are qualities like initiative resourcefulness tact and common sense that cannot be measured like temperature or attendance. Even attendance records fail to show values for the time of the man who sticks strictly to business may be worth double that of the man who sits about and goes to sleep or reads a staff library. Quality is hard to put in graphic symbol. Quantity

however measures many things as when faithful attendance in a dispensary clinic rapidly develops it. Reprints will give no uncertain idea of the thinking and the study done by a man. Mortality and morbidity records will check reckless men if they know that pitiless publicity occurs. At any rate it may be said that in hospitals at present attempts like the foregoing should better present conditions wherein there is practically no checking up of either regularity of attendance — that is quantity or reasons for grave failures or errors in diagnosis or follow up or progress on the part of the individual — that is quality. If it be true for instance as is alleged that a head of a joint department of gynecology and obstetrics pays practically no attention to midwifery — is almost unknown in his obstetric ward — it is very easy to see by a ward signature book and a chart what time he gives to each service. If a hospital is not studying its results at all and if its men are publishing nothing a charted publicity should show this up. Of course there are in your group head workers and hand workers but your group as a whole must give evidence not only of craftsmanship but of study of knowledge of the work of others through clinical travel and of attendance at society meetings of consultations with other departments and of thinking on paper. Some graphic records must be shown so simple and so public that the trustee who runs may read or even the head of the department even he who is trying to make his fees catch up with all the years he put into pure science.

If all charts of attendance. The nearest to a cure all that we know is publicity. Suppose a department in its own staff room had its secretary enter on a chart at a cost in time that we have figured as an hour a day the hours of attendance the operations and deliveries and the end results taken from the histories we would lay bare to each other and the trustees our actual work. I submit two charts for my department in Brooklyn Hospital covering nine months. I hear you say

totals and averages could be shown with infinitely less labor by footing up columns. What need then for this elaboration? Because for the study of the distribution of the

facts surfaces of frequency like this are required. Regularity of attendance — fully covering a service like obstetrics — can be shown only in a table of frequency or in one of these surfaces of frequency. Its extraordinary irregularity could hardly be otherwise demonstrated. If this is the way (Chart 4) a man's hospital work fluctuates, how can he plan his day or night with any regular hours or fixed engagements? (In this chart each horizontal unit stands for one day the upright square represents one hour's attendance or one bed filled one day.)

Chart 5 demonstrates the only way one can watch fluctuations in the number of patients or any tendency to steady increase or decrease or seasonal fluctuations. For such a graph to be of value all the factors affecting the conditions in the institution must be known such as increase of available rooms on a given date or a poliomyelitis epidemic that keeps private patients away or a raise in rates. This chart shows that the summer months notwithstanding the falling off of gynecological patients are very well covered by the staff. It shows the obstetric demand all the year and a gratifying increase in private obstetric cases choosing to go to a new hospital that offers a maximum of privacy and convenience. The constant variants show a need of always having some empty beds ready for emergency labors. It exhibits in gynecology an interesting peak after the summer heat and vacation and another in the rush before hot weather. It raises the question of how to eliminate the summer depression and whether we shall fill the gap by lowering prices as the hotels do.

Publicity concerning mortality and morbidity (such as suppuration in clean cases and recurrence after prolapse and retroversion operations) is keenly to be desired. Here each man is charged with his errors and it will be done as fully as our new end result organization can manage. Here it is seen that one gynecologist gives his associate and assistant very little operating (though the associate is noted as assiduous in attendance and incidentally known to be equipped with excellent operating technique and judgment) whereas the colleague when on service divides

evenly with his staff. The high infant mortality strikes one in the face—one in nine—and opposite each dark square must stand a reason such as eclampsia or previa or prematurity. The senior's long vacation and an associate's two months illness are here. Also the answer to the trustees' question whether we really use the clinical assistants. They ask, "Are you overloaded? Can you eliminate any men?" The answer may be that the whole associate lines in Chart 4 run very thin indeed. (These men, however, are qualified to become full visiting, should the visiting fall out.)

*Large requirements in hours.* In summer (Chart 5 shows gynecological work dropped off about one third) and about equally in public ward and private room. The two services in the department run singularly close together (the ratio is 15 bed filled with 41 cases of women to 17 with midwifery patients) in the amount of time given to each service. For the 43 patients per day, how much service did the visiting staff do July? They averaged 11.1 of 1 hour in, including operations and delivery and duty round and dre sings. To state it otherwise, the visiting staff gave 4 minutes per day per patient in the hospital running nearly two minutes longer for gynecology than for obstetrics. Use this study as a means for making an estimate of how much time for how large a staff a conjoint department or a single service would need. Thus we would say that in gynecology or obstetrics for every ten beds occupied you should require not less than four hours hospital service a day by your visiting staff but that five hours would be far better and this would cover laboratory, oversight, study of histories for publication, seminars and general staff meeting but not dispensary service other than in punction and consultation.

*Proportion of beds gynecology obstetrics may claim.* Looking up a few statistics to find what proportion of general surgery is gynecology we have covered 4371 hospital cases. Eye, ear, nose and throat patients are excluded. Bellevue Mt Sinai St Lukes and New York Hospital report to the Society for Advancement of Clinical Study for the first

three months of 1915 and 1917 3063 operative cases of which 24.5 per cent is gynecology. The Methodist Episcopal Hospital's printed report for 1916 gives 19.8 per cent gynecological cases. At Brooklyn Hospital in 1916 19 per cent of the pay patients were gynecological and obstetrics gave almost the same percentage. A study of the data in detail with figures from other clinics here and abroad is under way.

Incidentally the genito-urinary operations culled from the above 3063 operative reports were just below 8 per cent. Therefore of the free surgical beds gynecology may fairly ask to have one in five and a genito-urinary service one in twelve.

*Standardization of charts and symbols.* We are studying to give effort by a uniform system of charts and symbols. What more forceful example could be given of the need of analysis than the lack of agreement on standard. Take the case of that graphic symbol which is more commonly employed both in general and hospital practice than any other. A doctor goes from house to institution or from one hospital to another on his duty round. The same fever record plotted in different places shows such continuing discrepancy as Chart 6 demonstrates. Here side by side the army hospital the American College of Surgeons the Massachusetts General and Barnes Hospital show a gross variation that would make any engineer scoff. For the series represents identically the same record. And in one famous hospital the chart differs in its entries between the medical and surgical ward.

Nor are our other graphic symbols in any better case. The baby weight charts present like discrepancies. In a specialty where graphic symbols could be of the widest utility we have no standard scale for diagrams of the body or its parts for they are all sizes, no symbol that means a fracture, no symbol that stands for pus or fluid or flatness or foreign body or cyst or tumor or any of the hundred matters that might thus be portrayed to the very great saving of time and with enormous addition to the clarity and usefulness of our scientific record.

How such graphic symbols may become embedded in practice and generally understood of all is perhaps best instanced by the practice of map making. Anyone used to maps understands that a horizontal line with two or three little short upright lines above it means a marsh. A continuous wavy blue line signifies a brook or river. Contour lines running in certain formations indicate steepness. The double parallel line is a road, the dotted lines running off from it a poor road, the single dotted line a trail or path. In charting fractures or the course of bullets or tubercular consolidation of the lung or a spreading pneumonia, there is no reason why a glance at the chart should not give instant information as to the findings and in many instances as to the progress from day to day. A temperature entry could show by a dot that it was a mouth record, by a cross that it was anal and so forth. Medicine has made a line start with its diagrams of the chest after Sahli's twenty years teaching. But while Lefevre follows the Berne professor, Cabot changes the symbol and in lieu of tiny circles on a chest chart to show the location of large moist rales, he uses crosses, and he may even employ the same symbol for different physical findings. Two major clinics have started to standardize letter symbols. The Massachusetts General Hospital issues a printed sheet of nearly five hundred Allowable Abbreviations. Many are in common use like the Latin *p r n* or *( U* for genito urinary, *F H* for family history, or *lap* for laparotomy. Some are disguises like *Den Ven* for *demes venereal* or *Gc* for *gonococcus*. Also the table shows schemes like this: Mict  $\frac{D}{N}$  — Micturates four times during day twice at night. The Mayo Clinic under Dr H S Plummer has long used for certain studies sheets with a numbering and lettering that enormously facilitate and abbreviate summaries and reports. Under (enter for instance line 11 reads

(N rm 10 Slight Mod 1 M k d 4 R q d h l p 5 B 1  
C 5 0 1 d f r s O 1 t Loss 1  
St 5th Wk 3 D g Max Los 1 m Na Lor  
13 Q dn p Los 4 I es Los

Let b h d kl sch U t r h g M th d n B 9 3  
5 4  
Phy 1 Diag 005 D f r e t 1 D gn p

And line 36 gathers a maximum of data concerning heart murmurs with a minimum of writing

36	Mf m — Fret	pd h f w m 34	{	APMTR	{	L t (APMTR)
				APMTRb		R d ti (APMTR)
				(b) k ( ) t d		
				( ) ll		
				Tm (pd) (S) y t l		
				(F) y t l (D) aa		
				t l		
				Q l y (hwm) (H h		
				(F) ft (W) h t l g		
				(Mf)		
				D g (t 34)		

These are long steps in the right direction but they are individual efforts in a matter where there should be a general agreement. Otherwise a man may go from one hospital to another to find perhaps a different meaning in each for a certain letter symbol.

*Chart of personal activities* Now as to the study of oneself and one's own symmetry and progress. You know whether you are saving more money or less than you were last year. You know whether you are better or worse physically than last year but what are you scientifically? Is your life haphazard or has it some definite idea and plan. Is it really true of you and me that we are not up to date unless like William Mayo we read medical literature two hours a day and failing to do that any given day we catch up some other day? How many hours a day can you operate and be fit? How many days in the week? What recreation pays best for the time spent?

It is possible also that charting would clear up some puzzles in office work. Study and comparison of your work and mine might be of use but without frankness we get nowhere. For instance if we ask the question at what rate of speed a patient may be properly cared for then we must answer straight. The dispensaries have begun to work out the question of how many patients shall be seen in an hour to prevent a rush that does injustice to them. I believe such a dispensary rate in gynecology and obstetrics has been established at a minimum of six patients an hour including new and old. In the office what should we do? Personally I cannot do better than one patient to thirty minutes averaging one new patient to four revisiting. An analysis of the time given to the new patient showed me that the history taking was consuming between twenty and thirty min

utes per patient where I did any justice to the matter. A blank was gotten up and no patient now appear without having filled it out unless he is one who has come for a consultation concerning a diagnosis of pregnancy or some very simple problem. It was easy to figure that whereas to write a history or dictate it cost at least twenty minutes to red pencil a form so that one's secretary could take off the summary cost but four minutes and this will include several questions put to the patient her cli and entries made by myself. Gynecology happens to be one of the things in which there are many questions asked which forbid the presence of a secretary (even though later the secretary will have to number and catalogue and file and index the history). Have you your secret (stenographic) code for the facts no one must know. Is a dictagraph feasible (as one New Yorker uses it) in all rooms of the office. How many examining tables are desirable and how many dressing rooms in order to lose no time. I use two tables. How many office hours a week are best. Who engages the nurse and arrange for the hospital room and operating hour. Do you see people without appointment only by appointment or come days with and some without. If you have the hatles how separate them from the hatted. In the case of many questions over the long distance telephone that call for swift reference to the patient's history what method gets it it quickest. My Index Visible brings the history to my desk telephone in forty eight second from the time the telephone ring in the booth in the hall. What proportion of your work is given free. Mine is 63 per cent. Does any patient get away without an opinion in writing or the description of her operation carefully detailed in type. If so why. Have you trained your fingers in your operating motions as women do theirs in piano playing. Have you trained your operating group as the artillery officer is training his gun crew.

Finally are you as dissatisfied with your happy go lucky rule of thumb methods as I am

An outline of how scientific management would take up a study of our problems has been given in previous papers<sup>1</sup>

SUMMARY

This plan for intensive study by the authoritative national body shows that no agreement exists as to standards in nomenclature of diseases operations or in truments or of procedure or of transference of skill or of form of organization and suggests some method of research. Sample charts of hospital personnel of a specialist group are given. A complete graphic wall chart record the work of a 32 bed service in gynecology and obstetrics covering nine months day by day. The patients bed days are plotted and each man is credited with his daily attendance while deaths suppurations etc occur during his period of responsibility are charged against him. The average requirement is found to be for every ten bed occupied not less than four hours a day of visiting staff time and five if study of histories seminars laboratory oversight and dispensary inpection are included. The proportion of free surgical beds gynecology may claim is deduced from operative averages in hospitals with and without a visiting gynecologist to be one in five. Queer variants in form of temperature charts are shown and the beginnings of standard symbols and abbreviations. Private office work is touched upon — the half hour average the filled written history blank with which the patient enters and the written diagnosis or operation report in her post session as she departs — and many lines of inquiry are started.

D k so R L St d d l f g Yh t k b  
p bl m J Am M A f gy i m b d Th Am J Ob y  
y m ix N 6 H S J t i m b d Th i b y of  
f B M S J t i m b d Th i b y of  
M d Rec 1P M t d p m f m mbers f h d p rs  
bns i T rs Am J Obs N Y s lxi N

## THIRTY CASES OF CÆSAREAN SECTION

By KENNEDY C MCLWRAITH M B TORONTO  
A o c t P f f o b t t U t y f T t

JUST ten years ago I published a paper describing a series of twenty seven labors in contracted pelvis without cesarean section. Prophylactic cesarean and the induction of premature labor were the measures I then advocated and I continued these practices with considerable success until about three years ago when I lost three babies in close succession the mothers recovering eventually after dangerous and painful labors.

Since then I have adopted the plan of subjecting the patients especially the primiparae to the test of labor and doing a section when satisfactory progress is not made. The success of the operation in these cases led to its use in other complications and I wish now to submit the results. Three of the cases reported were done in the public obstetric service of the Toronto General Hospital by my colleagues Doctors Kinnear and Scott and the rest either in that service or in private practice by myself so that the technique was practically uniform throughout the series. The cases may be grouped as follows:

**a Obstructed labor** a Primipara whose external measurements gave little or no evidence of the internal contraction but in whom the head failed to engage before or during the first stage of labor. All the mothers made good recoveries and all the babies were saved but one which died of hydrocephalus and spina bifida. One of these women went thirty six hours in labor yet both she and her baby made excellent recoveries. Eighteen months later she was successfully delivered of a second baby by section having declined to risk the loss of the baby by the induction of premature labor or to suffer the preliminary labor in this second case. There were eight cases in this class.

**b Patients** who by measurements or by the test of previous labors were known to have contracted pelvis. In this class also there was one hydrocephalic baby which lived only for

four days. All the others were alive and well. The mother of the hydrocephalic infant was in the medical ward of the hospital under treatment for tubercular knee joint. A month after her delivery I had to do a sub total hysterectomy for degenerating fibroid. From this operation also she made a good recovery. There were seven cases in this class making fifteen cases in all of obstructed labor all the mothers and all the babies except the hydrocephalic ones being alive and well.

**Hæmorrhage** 1. **Placenta prævia** Three patients were operated on for this cause all the mothers and all the babies making excellent recoveries. Other methods of treating placenta prævia have also given good results in my experience but where the child is viable and there is but little dilatation at the time of the hæmorrhage section seems to me the ideal plan. The child is quickly delivered and does not run the risk of asphyxiation through pressure on the placenta. In the high incision which we use the placenta is never encountered so mother and child escape the danger of further hæmorrhage. The risk of producing tears in the softened and highly vascular lower uterine segment is avoided and lastly one avoids the risk of sepsis which manipulation about the placental site from below undoubtedly entails.

**b Accidental hæmorrhage** One case. This woman was sent to the hospital after having a severe hæmorrhage. She declared herself to be eight and a half months pregnant but was I think less than that. She was bleeding very little when she came in and the fetal heart was good at a hundred and twenty beats to the minute. Fifteen minutes after this examination though no further external hæmorrhage had taken place it became slow irregular and almost inaudible clearly showing internal hæmorrhage. The os was tightly contracted and would not admit a fingertip. On opening the uterus a large black clot equivalent to about a pint burst

out of the incision followed by a few ounces of fluid blood and then the membranes bulged up into the wound. The placenta had been almost entirely separated. The mother made a good recovery and the child which weighed three pounds and a half lived a week.

3. *Toxæmia* a fulminant toxæmia of pregnancy. In this class I lost two mothers and two babies out of seven cases. Delivery was effected in this way because the os was not dilated nor oft and treatment had failed to prevent or control convulsions. One of the fatal cases was admitted to the hospital after having several convulsions. She was totally unconscious and had a high temperature at the time of operation. Both mother and child died. The second fatal case was that of a woman who was suffering from toxæmia blindness and who had many convulsions before coming to the hospital. She lived two days and a half and then succumbed apparently to the toxæmia. The child lived. In a third case the mother lived but the child died of convulsions. Another woman did not have convulsion but developed sudden blindness and other toxic symptoms before the onset of labor. As her symptoms were urgent and her pelvis small we preferred action to the induction of labor. She made a good recovery. I feel that the women who lived would probably have died whatever method of treatment had been adopted at the time I first saw them and that earlier section in the other cases forestalled the danger of their reaching the same hopeless state.

4. High blood pressure from toxæmia with acute oedema of the lungs. This was the case of an out of town patient who came to the city a month before delivery was due. I found her the next morning feeling very well but showing slight albuminuria and a systolic blood pressure of 160 and sent her to the hospital for treatment. That evening while talking cheerily to her husband she suddenly developed great dyspnoea and oedema of the lungs and in fifteen minutes her life seemed in danger. Morphine atropine camphor strychnine and oxygen were tried in succession giving but little relief. I wanted to do a

section but a skilled anesthetist declined to give an anesthetic in her condition. I ruptured the membranes and the relief of diaphragmatic pressure thus obtained gave her relief for some hours. The dyspnoea again became urgent and I did a section under local anesthesia and gas and oxygen. The operation took fifteen minutes. She was again relieved for a few hours but postoperative distention set in and she died of suffocation the lungs having completely filled up. The child lived only a few hours. My colleague Dr. Scott and I have published a fuller account of this and a similar case which I saw in consultation with him so I shall not enlarge upon it here.

5. *Vaginal sections*. The remaining three cases were vaginal hysterotomies. One was performed on a profoundly toxic patient after several convulsions. She did not long survive the operation. Another was performed on an emaciated and profoundly toxic patient about five months pregnant who came in with a diagnosis of pyelitis and pernicious vomiting. For a time she seemed to improve but later she sank gradually into a comatose condition and died at the end of a week. The autopsy showed tubercular kidney. The uterine wound and cavity were healthy.

The third was operated on under gas and oxygen anesthesia for pernicious vomiting. She made a good recovery. I believe that this last described procedure is the best method of emptying the uterus in grave cases of pernicious vomiting. If the vagina be patulous and the uterus low it is an easy operation. If the vagina is small and the uterus high it may be very difficult and it has but little application after the sixth month.

One of my cases had a severe rigor and a temperature of 106 degrees on the fourth day. I removed a small piece of membrane from the os and gave an intra uterine douche after which she remained perfectly well. Three patients I delivered a second time by section they all preferring that method to taking the chance of losing the baby by the induction of premature labor. In one case there was considerable adhesion of omentum.

tum to the abdominal scar in the others nothing but a few thread like adhesions here and there. The uterine scar was faintly visible and palpable in all. In one of them it was evident as a furrow when the uterus contracted but this seemed rather to be due to the rising up of muscle alongside of the scar than to any yielding of it. The patient who had the rigor as described above at the first operation I sterilized eighteen months later at her second delivery as she and her husband requested it. This was done by excising the tube from the uterine cornu and stretching the uterine peritoneum over the wound. The peritoneum covering the distal portion of the tube was stitched over the cut end of it. In these three cases the union was stout and would I judged have stood considerable strain.

It has been objected that if one delivery be by section all subsequent ones must be by the same method. My late colleague Dr. Ienton and I have each had cases of women however delivering themselves naturally at a second labor when the first had been by section nor does a repeated operation seem to be more dangerous than a first one. These points I have discussed in a previous paper. It is difficult to estimate what the danger may be of rupture at a second labor when the condition found at the first operation and the technique used are not described in detail. I venture therefore to append a description of the method used throughout the abdominal cases of this series.

The skin incision about three and a half to four inches in length is made wholly above the umbilicus. Thus when the uterus is emptied and sinks down there is no danger of adhesion between the abdominal and the uterine scars. The uterine incision is longitudinal from near the top of the uterus downward for from three to three and a half inches in the median line no attempt being made to avoid the placenta. I do not go directly through with the first cut preferring to work through into the uterine cavity with the handle of the knife so as to avoid injury to the child or cord. With scissors the incision

is then completed to the full length. Sometimes the dextro rotation of the uterus is so great that the left tube appears in the abdominal wound and some manipulation is needed to make the median line accessible. Care must be taken to cut at right angles to the surface otherwise a shelving incision is made and good apposition not so easily secured. While the child is being removed an injection of one cubic centimeter of pituitrin is given in the gluteal region. I prefer this to injecting it straight into the uterine muscle as being a less dangerous and equally efficacious method. After the removal of the placenta the interior of the uterus is gently rubbed over with gauze to ensure the complete removal of the membranes. In one case in which there was but little dilation of the os I pushed a thick strand of iodoform gauze down through the cervix as a drain and removed it next day *per vaginam*. I have not repeated this practice. The uterine incision is closed by three layers of sutures. The first of interrupted sutures of No. 2 chromic gut through the muscle layer only. I prefer this to the continuous suture which some of my colleagues like. The next layer is a continuous suture of No. 1 chromic gut which unites the superficies of the wound. The needle is made to enter and emerge close to the edge of the incision thus making the closed wound a narrow line over which the visceral peritoneum is easily drawn by a continuous Lembert suture of No. 1 chromic gut. A scar in this situation is not so liable to strain and stretching as one in the lower uterine segment would be. The liability to rupture is therefore less. In closing the parietal peritoneum the edges are everted so that peritoneum is applied to peritoneum and adhesion is less likely to take place between the scar and the viscera or omentum.

In conclusion I may add that when the time of the operation is known I have made it a practice in the last two or three cases to administer some form of lactic acid bacilli tablets for the week preceding and have had much less trouble with intestinal distention after operation.



## STUDIES IN PALLOPATHOLOGY

PATHOLOGICAL EVIDENCES OF DISEASE AMONG ANCIENT RACES OF MAN AND EXTINCT ANIMALS<sup>1</sup>

BY IOY I MOODIE I R D C CAGO  
D m f A m U IIR C Heg (M I)

**I**NVESTIGATION of the evidences of disease among ancient races of man and his predecessors the early vertebrates is limited to an examination of the lesions on their skeletal remain. The present study therefore may be regarded as a contribution to bone pathology. Since the diseases evidenced on the skeleton are only a small fraction of the maladies which the individuals of past ages must have endured palontological evidences give us but a faint idea of the prevalence of disease among the early races. The lesions on the bones however show a variety of interesting phenomena into the nature of which it will be interesting to inquire.

*Origin of term paleopathology.* Sir Marc Armand Ruffer during his studies of the evidences of disease among the ancient Egyptians as seen in their mummies applied the term *paleopathology* to the new science he was developing. His studies were received with the greatest favor and have aroused widespread interest. An extension of the subject is to be found in the study of the evidences of disease among the remains of the ancient races of man Pleistocene mammal (such as the cave bears and other associates of the stone age man) and the still earlier races of mammals reptiles amphibians and fishes the history of which covers many millions of years of geological time. This paper will deal with a discussion of the evidences of disease among these early races with a statement of the general significance of such a study.

*Diseases of the ancient Egyptians.* It is not necessary here to outline the studies of Ruffer and his associates on the pathology of the ancient Egyptian mummies since their essays are readily accessible and there have been several reviews of this work published. The pathological conditions (Figs 1 to 8) which are encountered are many. Pott's disease

small pox deforming arthritides of many kind tuberculosis arteriosclerosis fractures of many kinds necroses caries alveolar osteitis tumors and other interesting lesions may be discerned.

*Arteriosclerosis in the aorta of the Pharaoh of the Exodus.* The value of the study of mummies has been as important from an historical as from a medical standpoint. As an evidence of the community of interest between history and medicine may be mentioned the studies of Shattock and Puffer on the pathological anatomy of the aorta of King Merneptah the reputed Pharaoh of the Exodus. The section of this aorta shows the picture of typical senile calcification the bony parallel elastic lamellae being perfectly preserved and the intralamellar material thickly strewn with calcium phosphate. The mummy was found in the tomb of Amenhotep II who reigned in Egypt from 1448-1400 B.C. at Thebes and was unwrapped by Dr G. Elliot Smith who sent the aorta to the Royal College of Physicians of London. The finding of Merneptah's mummy at Thebes of course discomfited the adherents of the theory that as the Pharaoh of the Hebrew Exodus he must have been drowned in the Red Sea.

*Merneptah's appearance and bodily condition.* That Merneptah who reigned in Egypt from 1550-1530 B.C. thirteenth son and successor to Ramses II (1290-1250 B.C.) was a man of great age is shown by his baldness the whiteness of the little hair left the complete ossification of the first rib not its sheath alone and the calcareous patches of the aorta. Only one tooth was visible the upper right median incisor. Although the body was reduced to little more than skin and bones the redundancy of the skin of the abdomen thighs and cheeks indicate that Merneptah was a somewhat corpulent old man.

*Disease among the Pre-Columbian Indians of North America.* A study of the pathological

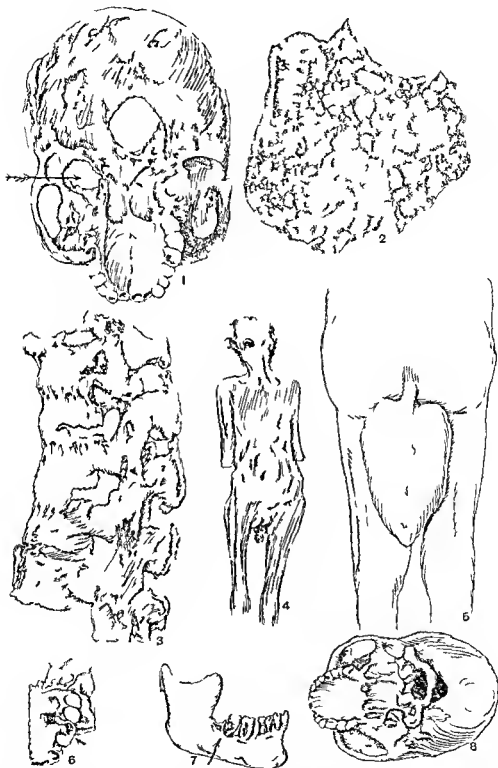


Fig. 1 Skull of ancient Egyptian showing erosion due to a carious aneurysm (After Smith and Jones)

Fig. 2 Portion of the maxilla from a mummy of the Twentieth Dynasty 200-1000 B.C. showing an eruption resembling that of a tumor (After Kuffer and Ferguson)

Fig. 3 Ankylosed lumbar vertebrae of an Egyptian mummy due to osteoarthritis (After Smith and Jones)

Fig. 4 Mummified mummy of a Christian (Coptic) 400-500 A.D. showing the rectum (After Ruffer) The body is from the upper Egypt

Fig. 5 Portion of the body of a girl from the Beni Nune

cemetery showing anal or vaginal prolapse of the viscera (After Smith and Jones)

Fig. 6 Maxillary bone of an Egyptian (Coptic) 400-500 A.D. showing the effects of caries and necrosis of the palatal alveolus (After Ruffer)

Fig. 7 Mandible of an Egyptian (Coptic) mummy 400-500 A.D. showing the effect of caries and pyorrhea alveolaris (After Ruffer)

Fig. 8 Skull of an Egyptian showing ankylosis of the atlas to the skull as a result of spondylitis deformans (After Smith and Jones)



Fig. 9. Skull of an early North American Indian. The skull shows evidence of syphilitic lesions, particularly in the frontal bone and the metopic suture. The drawing is a reproduction of a photograph of the original specimen.

analysis of the early North American Indian and of the ancient races of South America would doubtless furnish very interesting material. A complete account of the pathological lesions found in these races has not yet been given but occasional discussions of the evidence of disease among the people are to be found in the anthropological literature dealing with the subject. A survey of the literature gives an interesting insight into the possible conditions of the peoples as regards disease. We owe the majority of the studies on this subject to Alks Hrdlicka and one of his figures of an Indian skull (Fig. 9) showing the effects of symmetric osteoporosis in infancy and the recovery therefrom is published herewith. Eaton has stated that syphilis is evident in the skeletons of the later Incas (pre-Columbian of about 1400-1550 A.D.) and has given some excellent figures of these lesions. His results are discussed below.

Hrdlicka (3) and Lundgon (4) have studied the evidences of pathological processes among the remains of the early North and South American Indians but their results have not been summarized. From a brief survey of

these studies it appears probable that the early inhabitants of the Western Hemisphere were singularly free from disease of any kind so far as we may judge from the remains which are available for study. The indication of syphilis among early North American races have been reviewed by Lamb (5). He finds from a review of the literature and a study of new evidence that the indication of syphilis among the pre-Columbian races of America are inconclusive, agreeing with the opinion expressed by Virchow at about the same time.

*Syphilis among the Incas.* Eaton (6) however is very decidedly of the opinion that syphilis was present among the pre-Columbian Peruvians and in a radiograph of a young male left tibia he shows what he regards as evidences of extensive syphilitic disease. On other skeletons he has discussed the existence of syphilitic lesions in adults of both sexes as well as in the skull of a child about 7 years of age. In the pre-entire syphilitic necrosis of the frontal bones and an abnormal condition of the metopic suture. Some of Eaton's figures (Figs. 10 to 13) are published herewith. Concerning the child's skull Eaton says: "The skull and lower jaw of a child about seven years of age from this grave are chiefly interesting pathologically. The destructive process of inflammatory disease having resulted in two perforations of the frontal bone. One lesion is situated low on the frontal bone a little to the left of the midline and the other on the right near the coronal suture. In both the lesions the destruction of the inner table has advanced widely beyond the limits of the perforations; in fact the two lesions are thus connected endocranially. There is also to be noted a similar destruction of the inner tables of the parietal bone along the anterior part of the sagittal suture. The assumption that the lesions are syphilitic is based on the above described conditions which are more likely to be observed in the syphilitic subject than in any other. Especially is this likely to be the case when accompanied by the destruction of the nasal point." Eaton's figure 1 photograph is not conclusive.

*Syphilis in Egypt.* Syphilis has been reported to occur among the ancient Egyptian

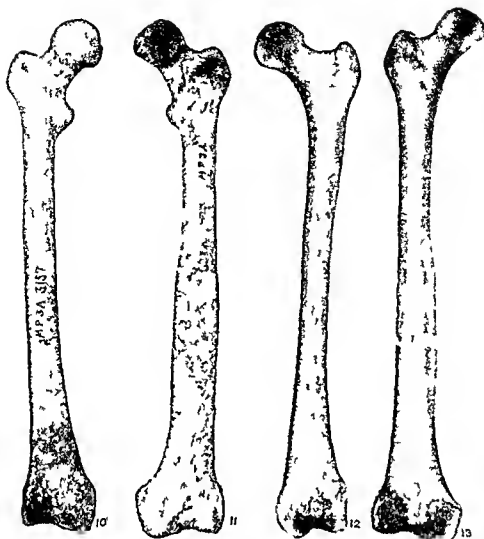


Fig. 10. Right femur of an adult female pre-Columbian Incan found in a cave of the Machu Picchu region, Peru. The bone appears free from disease and is published for comparison with the next femur. About 1400 A.D. (After Eaton.)

Fig. 11. Left femur of the same skeleton showing extensive syphilitic periostitis. The fracture was produced after the bone was found. (After Eaton.)

Figs. 12-13. Skiagrams of the right and left femora of the same skeleton, anterior and posterior view. (After Eaton.)

as cited by De Morgan (1) although the evidence he presents is inconclusive. De Morgan cites the work of Fouquet (13) who initiated the study of the pathology of the ancient Egyptian mummies.

Lortet and Guillard (14) in their study of the fauna of ancient Egypt as seen in the mummified remains of the sacred animals preserved by the ancient Egyptians such as birds, lizards, crocodiles, antelope, bulls, dogs, cats and other forms of vertebrates have reported lesions of syphilis on the skull of a young woman. The lesions take the form of irregular erosions in the outer table of the

frontals and the anterior parts of the parietal bones.

*Evidences of syphilis among early human races.* In studying the evidences of syphilis among early human races it is very important to keep in mind the nature of the fossil bones of extinct mammals which show hyperostoses and carious roughenings and thickenings which from an external examination usually show the same pathological features as do the syphilitic bones of recent man where the diagnosis is made at autopsy. Virchow called attention to this similarity in his paper on the history of syphilis and he described and



disease but no description of these lesions has yet appeared

The evidences of disease among the late stone age (neolithic) and the older stone age (paleolithic) races of man have been studied by Raymond (1) and Le Baron (2). Mention of sundry pathological lesions has also been made by Keith (15). These studies are necessarily based on the remains of human races which occupied European countries since no representatives of these groups of people are to be found in the Western Hemisphere.

*Disease and injury among the Stone Age men.* The remains of the stone age men of Europe occasionally show evidences of disease and injury. One of the most interesting cases of injury in an early man is a specimen of a lumbar vertebra showing a stone arrow point embedded deeply in the visceral surface (Fig. 14). The individual was shot through the abdomen and the arrow must have been coming with terrific force since it penetrated the abdominal wall near the umbilicus, plowed its way through the viscera and embedded itself so firmly in the body of the vertebra that it has remained fixed after thousands of years. The individual may have died of peritonitis or he may have died from some other cause but there is no indication that he lived a great while after he was shot since there is an absence of callus around the wound.

A skeleton of an extinct buffalo or wild bull as mounted in the museum at Copenhagen shows some rib injuries (Fig. 15) doubtless inflicted by the arrow points of stone age hunters. Other evidences of disease and injury may be found in the archeological literature and collections. Mention will be made of these elsewhere.

*Early indications of trephining among an ancient man.* The fact that early man performed the operation of trephining or trephining indicates the presence of disease in the brain either tumors or infections regarded by early man as due to the presence of an evil spirit. By scraping the skull with obsidian knives they perforated to the dura mater and allowed the endocranial pressure to be relieved. The operation might have been performed for the relief of a depressed

fracture or was perhaps purely ceremonial and not therapeutic at all. The procedure must have been excruciatingly painful and one wonders at the relative frequency with which it was performed. Keith (15) has described and figured a skull from a Neolithic (30 000 years ago) sepulchre in France which had been trepanned doubtless by scraping with a flint in three places. The patient had recovered for the margins of the openings were healed over. The operation was widespread and evidences of it are found in nearly all portions of the globe. The ancient Peruvians performed it often. Hatcher (16) has reviewed the entire subject of trepanning among ancient races and has given other interesting evidences of prehistoric surgery and infections.

*Fractures and disease among the Neolithic men of France.* Further evidences of disease among the ancient stone age men have been given by Paul Raymond (1) who has described and figured in the remains of Neolithic man of Europe cases of spondylitis deformans, arthritis of the knee, congenital luxation of the femur, fracture and repair of the femur with the formation of callus. He also reports syphilis in Neolithic man 30 000 years ago as evidenced in a pathological humerus and radius. His diagnosis however is open to criticism since we have no evidence that syphilis can be differentiated on such findings as he has reported.

Raymond reports that all types of fractures are to be found on the prehistoric bones he studied. He discusses the frequency of arthritis deformans on the skeletons of these ancient races attributing this deformation to the fact that Neolithic man lived in caves but he failed to note that the ancient Egyptians who did not live in caverns were afflicted with the same disease. Spondylitis deformans also occurs among the animals of Egypt as seen in the embalmed remains. Raymond also refers to neolithic evidences of Pott's disease and scoliosis.

*Fracture of the ulna of the Neanderthal man.* The most famous of the skeletal remains representing early fossil man are the portions of a skeleton of an extinct species of man found in a cave in the Neanderthal in the

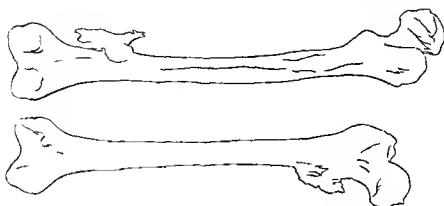


Fig. 1. (1) and (2) The ulna and humerus of the left arm of the skeleton of the Rhine province of Russia, and fully described by Scharfhausen in 1857. Some of the skeletal elements show pathological lesions. The proximal end of the left ulna (Fig. 16) doubtless had suffered fracture of the olecranon which had healed with a widening of the articular surface. The left humerus shows signs of an injury in consequence of which it doubtless remained much weaker than the right bone. Caries has been said to be evidenced on the occiput but this has been denied by Schwalbe. Among other pathological processes seen in the skeletal remains of ancient man in Europe may be mentioned alveolar alveolar necrosis and arthritides. Dental caries is very rare among early human races although occasionally teeth are lost not from caries but from abscess (gum boil) forming at their roots as has been reported by Keith (15) in a Paleolithic Englishman who lived 40,000 years ago.

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*Pathology in the oldest man-like form* (500,000 B.C.). The oldest well authenticated skeletal remains of man or man's precursors on earth were found in 1891-2 by Dr. L. Dubois then a surgeon in the Dutch Army while engaged in paleontological excavations along the left bank of the Bengawan River near Trinil in the central part of the island of Java. These important remains were described by Dubois (7) and his work was immediately received as one of the greatest contributions to the study of the antiquity of man. A rather extensive literature has grown

up around these remains to which an age of half a million years has been assigned. The interest to us in these curious remains is that the left femur which was found entire shows marked exostoses indicating the presence of a pathological condition.

Under the leadership of Rudolf Virchow on December 14, 1893, there was called a special meeting of the Berlin Gesellschaft fuer Anthropologie, Ethnologie und Urgeschichte to consider especially the remains of *Pithecanthropus erectus* as these elements of man's precursor were called. Attention was called by Dubois, Kollmann and Virchow to the exostoses on the femur. Virchow read a paper (8) in which he showed that the pathological condition (Figs. 17 and 18) in the extinct form was similar to exostoses in recent human skeletons and he exhibited examples (Figs. 19 and 20) of such diseased bones from the collections of the Berlin Pathological Institute.

The ancient form represents the oldest human type and the above review of the ancient human races shows that in every race and in every country some evidences of disease are present although one is struck by the scantiness of the evidence of disease as compared with the abundance of remains available for study. A study of the remains of these early races lead us to no conclusion regarding the origin of disease. Since we have the remains of Pleistocene mammals which were associated with ancient man and diseased it may be well to see what the condi-

tions of disease are among the ancient races of mammals many thousands of years ago.

*Pathology in the cave bears.* The literature on the pathological conditions of the Pleistocene mammals is rather extensive though scattered and only brief references will be made to it in this place. Diseased conditions among the cave bears were first noted in 1774 by Esper who described what he regarded as an osteosarcoma on the femur of a cave bear Mayer (9) however restudied the specimen and regarded the lesion as a fracture (Fig. 1) with necrosis and callus but the specimen has never been adequately described. Of the fifty papers published which make mention of the pathological conditions of fossil animals eighteen of them deal with the diseased nature of the skeletons of Pleistocene mammals chiefly the cave bears which were very abundant in Europe. The diseases of the cave bears cover a wide range as may be seen from the observations of the surgeon Walther (10) who described numerous fossil Pleistocene bones showing pathological lesions. Walther was much impressed with the undoubted evidences of disease thousands of years old. A right femur of a cave bear (Fig. 1) exhibited extensive necrosis with widespread roughening of the bone. He observed also ossification of two dorsal vertebrae (Fig. 28) due to arthritic lesions, caries in the left mandibular ramus especially extensive in the alveolar fossae and processes of the canine and molar teeth resulting in extensive absorption of the processes similar to the modern results of alveolar pyorrhea. Another mandibular ramus exhibits a heavy thickening of the processus alveolaris associated with an extensive carious surface and numerous osteophytes. A lumbar vertebra is widely necrosed by caries which Walther assigns to tuberculous spondylitis. Various types of fractures and infectious indications of osteomyelitis in atlas ankylosed to the skull atrophy and other pathological conditions are seen among these old cave animals which lived and died hundreds of thousands of years ago.

The majority of the lesions described by the writers on the pathology of the animals of

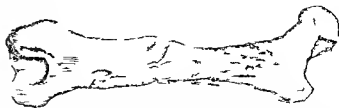


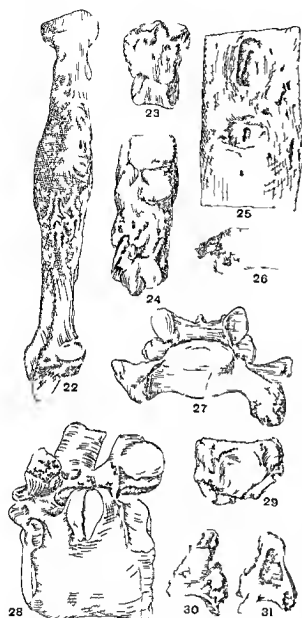
Fig. 21 Left femur of a European cave bear 500,000 years old showing an oblique fracture of the lower portion of the shaft with various necrotic sinuses. The bone had healed with little or no shortening. (After Mayer.)

this great period were regarded as due to some form of traumatism. Some are regarded by Walther as due to the weather such as gout (Hoehlelicht) and other arthritic lesions. Concerning the cause of disease Walther concludes his paper with this philosophical statement: "We have no historical data to prove how old disease is nor when it first attacked the poor sinful human race. In every case diseases are the faults of inheritance and since they are visited upon the sons and daughters because of the sins of their fathers they are true sins of inheritance." How Walther would apply this philosophy to the cave bears is not clear.

Lesions similar to those seen among the cave bears are to be found among Pleistocene mammals of California. The Rancho la Brea beds near Los Angeles have furnished many interesting skeletons of wolves, elephants, saber-toothed tigers, sloths and birds many of which show evidences of disease or injury. These skeletons are found entombed in asphalt so that the nature of the bones is unchanged and one is able to study the lesions as if they were recent bones. A few of the diseases and accidents are shown in Figures 32 to 36.

*Tabular view of the Pleistocene.* A tabular view of the Pleistocene the last geological period just preceding the period in which we are now living is given below. The Recent Period began 25,000 years ago so that the Pleistocene has ended long ago. The Pleistocene witnessed the origin and evolution of man and the extinction of certain groups of mammals. This is the most important geological period in the history of man for in it the foundations of our modern civilizations were made.





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*Disease and injury among ancient mammals* Evidences of disease older than the Pleistocene are numerous and extend back into geological time for many millions of years. The evidences for such a statement are to be seen in the lesions of the fossil remains of the bones of animals whose skeletons are preserved in the rocks. The nature of the evidence is necessarily slender since it is entirely osteological. A brief discussion of some of the diseased bones of fossil mammals may be of interest.

The most interesting example of duplicate exostoses (Fig. 38 and 39) seen among fossil mammals is found on the right and left radius of *Daphnion felinus*, an early dog from the Oligocene of Nebraska. The skeleton of this interesting dog is described by Hatcher (11) and the drawings shown herewith are taken from his memoir. The nature of the lesion may be seen from an examination of the figures of the right radius (Figs. 38 and 39). If parallels for this interesting case exist among human skeletons a comparison would be interesting.

Osteomalacia or some similar disease is evidently the cause of the lesions seen in the tibia fibula and tarsal bones of *Limnocyon potens*, an early carnivore from the Washakie Eocene nearly 3,000,000 years old. The bones show considerable exostoses which may have been due to an infection of some duration or to nutritional disturbance.

The nature of fractures among early mammals may be seen from an examination of the left leg of *Teleocyon*, a carnivore from the Lower Miocene of Wyoming. The animal had suffered a complete oblique fracture (Fig. 37) of both fibula and tibia and the injury became infected with resulting necrosis and the formation of osteophytes. Fractures of many

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 hyp t j h d tra d f p m th t b x f ca  
 F 9 Sp dylt d f m th t b x f ca  
 b (Aft M y )  
 Fg 9 C l t b f c b h g  
 p l th l f p dylt d f m  
 (Aft S hl )  
 I g 3 d 3 A d d p l i g f f be  
 h m l t f f (Aft V h )

TABULAR VIEW OF PLEISTOCENE PERIOD

G l g l l g l od	St C lt d C l l P od	I	H m T y p	A m l T y p
			M l	R f t
R e d t 5 00 y r s	B o e g N l t h	P h t N e o l t h	A t f m d m	R l p o d
	A l i a T d o M g d l n u S i t A g n e n 5 000 y r s	U r p e P l t h	G e l l C o M g n G u n l d a	
	M t 000 y r s A h e u l 75 000 y a r s C h l l n 90 000 y r s P C l l 5 000 y r s	L l l l t h u	N d t h l ( t h p )	A t h r a s e s l p h t h p p p t m j w o o l y o c h r y m m h l d b e r s
P l	T h d C l l P d 000-00 000 y r s			
T i 500 000 y	S d l t g l l P r o d 00-35 000 y r s			
	S e d G l l P d 35 000-400 000			C b e d t h a s o c t
	F r s t I t g l l P r n d 5 000-45 000 y		H d l b e g M	
	F r s t G l l a l l r i o d 475 000 00 000 y r s			S b t o o t h d l h e r d l p h a t E t t m m n l
P c d 500 000 y	5 5 000 y f o m t h l f t h P l o c t t h p e f t h R t		M c u P c b t h p T l h	E t t m m n l
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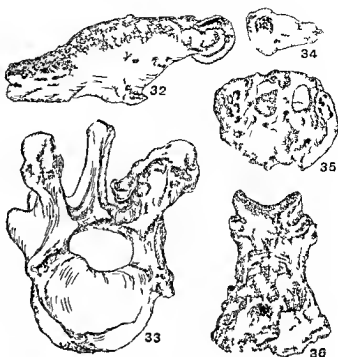


Fig. 32 Metacarpal of a wolf from the Pleistocene Rancho La Brea beds of California 50000 years old showing a fracture with callus and exostosis. A section through the fracture is shown in Figure 34.

Fig. 33 Lumbar vertebra of a saber-toothed tiger cat from the Pleistocene Rancho La Brea beds of California showing an hypertrophied process acc. on the right side.

Fig. 34 Section through the fractured portion of the metacarpal shown in Fig. 3.

Fig. 35. End view of the phalange of a wolf from the Hellocene of the Pancho la Brea beds of California showing the erosions of osteomyelitis (?) and other necrotic indications.

Fig. 36 The same bone from a dorsal view showing the erosions above mentioned and the carious roughening of the surface.

kinds are especially numerous among fossil animals and the results in healing are quite comparable to those in modern human bones.

Dental caries among extinct crebrabres  
Dental caries (Fig 41) is often met with among fossil animals. The case figured is that of a lower molar of a three toed horse *Merychippus campestris* from the Miocene of Nebraska. The lesion does not differ

essentially from similar lesions today Joseph Leidy in 1886 called attention to caries in the mastodon The supposed caries appears as an irregular excavation immediately above the crown of the tooth about one half inch in depth the surface of which appeared to be irregularly eroded Caries has been further mentioned in the fishes from the Permian by Renault who ascribes the result to several types of bacteria Dollo has mentioned an example of caries in one of the lower teeth of a Mosasaur one of the large Cretaceous reptiles

*Pathological evidences among extinct vertebrates older than 3,000,000 years.* The animals which preceded the mammals were as liable to disease as were the mammal themselves and it seems possible that the mammals may

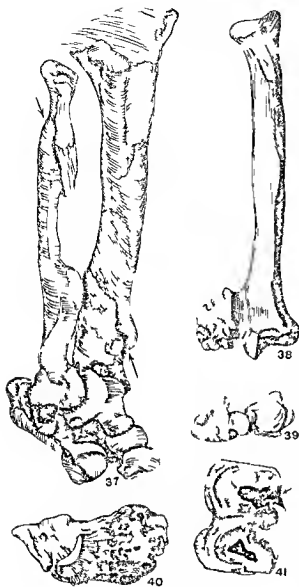


Fig 4 Ad dl mb y cm pt le  
pl f m th t f h sas g o o o o o  
y F ld Th d dl t th a  
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have acquired some of their diseases from the preceding reptiles. A few example of disease and injury among the dinosaurs may be shown here as continuing the evidence of disease back into geological time. The bones of the gigantic reptiles, the dinosaurs were for the most part old and fractures (Fig 4) of these bones are always simple transverse breaks. Exostoses, necrosis, tumors and other interesting lesions are to be seen among the Cretaceous reptiles and among the preceding forms as far back as the Carboniferous when the first known evidences of disease are met with. The early and greater part of the life history of the earth was free from disease or evidences of its presence have not yet been seen.

**Microscopic study of ancient lesions.** It is readily possible by petrographic methods to study the bone lesions microscopically as can be seen by referring to Fig 44 which is a drawing 700 diameters of a lesion due to osteoporosis on the humerus of an ancient reptile 16 000 000 years old. Often in studying these ancient bone microscopically one sees bacteria included within the lesion.

Fig 37 L g b d t f l l d l k  
m l f m th N f N b k h d t th  
l t f t f th t b l d t b  
f g 38 R h t d f D pl l l l d g  
f m th Ol g f N b k 500 000 y k d g  
h g th l d l f t th h h d  
m tched by d pl t l f th th d  
(Aft H t h )  
f g 39 f d i th m b h  
f g 38 f  
f g 4 A ph l f t m m m l k  
M y f f N b k 000 000 y l l h g  
Ol e f N b k 000 000 y l l h g  
te e c L m l h g (Aft L d y) M y l p p  
f g 4 f m th l N f N b k 000 000  
y l l h t th d t l



Fig. 44. A drawing of a microscopic section of a lesion of osteoperiostitis in the humerus of an ancient reptile 25,000,000 years old showing the nature of the perforating fibers of Sharpey and the osseous lacunae with the right canaliculi. The fibers of Sharpey run in bundles and the high power drawing shows the nature of one of the bundles largely confined to the length of the nature.

These have been especially well studied by Renault who has been able to demonstrate natural cultures of bacteria preserved in silicon.

*Origin and nature of ancient diseases.* So far as present evidences may be read diseased conditions are very ancient and have attacked animals and plants for many millions of years. The nature of disease among ancient animals is not different from the pathological processes which take place in man at the present day. Disease doubtless started when races of animals began to go toward extinction but much work needs yet to be done before we can read the history of disease as it is seen in the skeletal remains of animals which lived many millions ago.

#### SUMMARY

The remains of fossil man and extinct animals show evidences of diseases which are comparable to recent lesions. Indications of disease are rare compared with the abundance of remains of ancient races. This may indicate that disease has not been so prevalent in the past as at present although it must

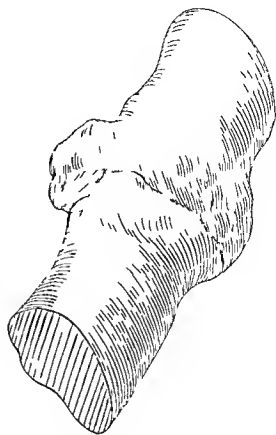


Fig. 45. A simple fracture in the rib of a large dinosaur mounted in the Field Museum of Chicago. The huge reptiles attained a weight of nearly forty tons, a length of nearly seventy feet and a height of fifteen feet. The rib measures seven inches across and has a length of nearly eight feet. It must have taken a terrific blow from one of his fellow dinosaurs to have broken the rib which healed with the formation of considerable callus.

be remembered that the evidence is all skeletal. Some of the lesions seen on fossil and subfossil remains are osteoma, hemangioma, fractures, callus, osteoperiostitis, necrosis, caries, alveolar pyorrhœa, hyperostoses, osteomalacia, spondylitis deformans. These and many other interesting lesions show us that disease is no new thing but has been manifest in a diversity of forms for many millions of years.

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## MECHANICAL TREATMENT OF PERIPHERAL NERVE INJURIES<sup>1</sup>

B. BYRON STOOKEY, M.D.

C. F. R. I. R. I. A. m. M. d. I. C.

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**T**HE problem of peripheral nerve injuries does not begin with surgical interference nor does it end with operative procedure. The treatment of these cases requires an understanding not only of peripheral nerve surgery but also of the mechanical and postural management of the resultant paralysis. An intimate knowledge of the attitude of these patients toward their injury is also essential. Due to their frequent hopeless outlook there is probably no organic lesion in which the personal element of the surgeon may more profitably enter. Their convalescence is not a matter of week but months and years. They constantly see their comrades though apparently more seriously wounded leave the hospital while they are still retained. Their wounds though outwardly healed show to them no real appreciable evidence of improvement. Complications often develop they frequently may suffer exquisite pain. In certain cases traumatic ulcers occur and cutaneous regressive changes are constantly apparent. In no class of organic injuries is there more imperative need for the will to recover and in none is it more often wanting. Constant effort especially in the early stages of regeneration

should be devoted to the use and reeducation of the paralyzed muscles. Instead many patients by this time have become resigned to their deformity and have given up the will to regain control of the part. Frequently there is superimposed on an underlying organic lesion an element of functional disorder in itself many times more trying to handle than the nerve injury.

However skillfully surgical interference may remove all obstacles to the downgrowth of the neuraxes and facilitate their further growth the return of motor function may not occur unless there has been comprehensive preoperative and postoperative treatment. The role of such treatment is to prepare the paralyzed parts so that after nerve regeneration and neurotization there may not occur peripheral obstacle to return of function. Such obstacles may reside within the paralyzed muscles which have lost their native power of contractility and have undergone marked regressive change which have been hastened and rendered more complete by force of gravity, overstretching and poor nutrition. Or obstacles may occur in the antagonistic muscles which have been allowed to undergo adaptive shortening with final permanent contractures.

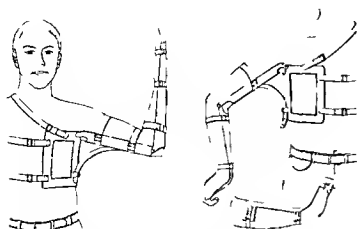


Fig. 1 (at left) Adjustable abduction splint with adjustable forearm piece for paralysis of the fifth and the radial nerves. The arm is held in abduction and external rotation with the hand in supination. By altering the pin and lever to the arm piece the arm can be held in any desired angle of abduction. Forearm piece may also be adjusted by screw lock to various degrees of flexion. The splint is made of aluminum and lined with felt.

Fig. (at right) Author's splint for total and partial paralysis of the musculospiral. A (above) Adjustable aluminum abduction splint with forearm piece to maintain the wrist in dorsiflexion. Arm held in abduction with the wrist dorsiflexed. B (below) Small dorsal skeleton splint (similar to Jones splint only dorsally placed) to prevent wrist drop. Consists of a narrow dorsal piece and annular portion extending across the proximal phalanges of all five fingers. By being dorsally placed greater freedom is given to the palm. Note angle of elevation of the wrist.

limiting materially the proper range of motion. The purpose then of suitable and adequate mechanical treatment is to attempt to maintain the nutrition of the part and prevent overstretching or contraction of the muscles paralyzed or contractures of their antagonists.

It has long been recognized that if a muscle is permitted to be overstretched it may not regain its contractility even after neurotization and hence though the nerve injury had been repaired return of motor power might not take place or be greatly delayed. It has been shown many times in the treatment of anterior poliomyelitis that muscles which have been paralyzed and not treated posturally in which overstretching had taken place frequently show a return of function when the postural deformity has been corrected and the overstretching overcome. Neurotization though complete was unable to bring about a return of contractility. A paralyzed and overstretched muscle loses more permanently

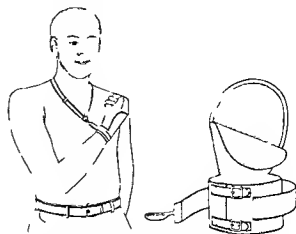


Fig. 3. Author's first tray for paralysis of the musculocutaneous. (at left) Arm held in semi flexion and drawn across to the opposite shoulder. Hand is held in supination. Metal dorsal extension piece supports the hand and prevents it from falling into dependent position. The small strap about the wrist is attached only to the volar surface in the radial side and passes under the wrist thus assisting in maintaining supination. B To illustrate wrist strap and metal extension. Leather is ripped and turned back showing metal piece which extends from wrist across dorsum of hand. Note line of attachment of small wrist strap and that it passes under and behind the wrist.

its contractility and undergoes more marked regressive changes than a paralyzed muscle in which overstretching has been prevented.

The first cardinal principle then of mechanical treatment of peripheral nerve injuries is to obtain relaxation and prevent overstretching of the paralyzed muscles.

There are two main types of apparatus, those which aim to prevent overstretching and correct faulty position and those which attempt to replace a part of the movement lost. The latter rarely are efficient in their correction of the total deformity, e.g. the spring appliances to prevent toe drop endeavor to replace the dorsiflexion of the anterior group ignoring the associated postural deformity due also to paralysis of the peronei and the coincident disturbance in the mechanics of the foot and the faulty deviation of body weight. To these we will refer again. An appliance is to be preferred which tends to correct the total deformity and prevent overstretching rather than replace movements lost. Each appliance should be made for each individual case. Only general types will be outlined here which have proven of value. Modifications should be made when

ever expedient. All splints should be altered and changed according to the stage of progress and repair of the palsy.

The importance of mechanical treatment is clearly indicated by the report of Laquerriere and Lécyr, who state that in fully 50 per cent of cases reporting for physiotherapy deformity might have been avoided by proper splinting and by surgical interference not too long delayed.

The ideal apparatus should be light, simple, easily applied and removed, should immobilize no more than is necessary, should be cheap and inconspicuous. Furthermore it must treat the total deformity—not merely one of the apparent faulty positions. The traps should be as far as possible not constrict the muscle bellies but rather fall upon the tendinous part. Great caution must be observed to avoid pressure sore particularly in cases of contractures and where there is scar tissue, since it must be remembered that there may be anesthesia not only of the superficial parts but also of the deeper structures and warning by means of pain may not be given.

All splints when removed at night should be replaced by other apparatus more comfortable and approximately as efficient. Appliances should be worn constantly without ever once allowing the muscles to become overstretched. According to Colonel Sir Robert Jones one single indiscretion may retard all that has been gained by prolonged treatment.

*Early mechanical treatment.* The mechanical management of peripheral nerve injuries may be divided into the immediate and the late or subsequent treatment. The former include the first few weeks until the associated injuries have progressed far enough to permit of definite treatment directed toward the nerve lesion. The early management of these cases will depend very largely upon the concomitant and coincident injuries. However, given a case in which the nerve injuries alone predominate, i.e. without tendon or bony injury, the extremity should be placed according to Stoffel, so that the severed nerve ends may be brought into close proximity and there held for a few weeks during

which time the nerve end will become anchored and a more relaxed position may then be assumed.

This is in fact applying to nerve injuries principles long in usage for muscle and tendinous lesions where immediate repair has been impossible. For nerve injuries it seems to be of questionable value for after the immediate retraction of the nerve ends at the time of severance shortening is the case in injuries to tendon and muscles due to contraction of muscle bellies and pulling asunder of the tendon end does not take place. The severed nerve tends to assume immediately a definite position and to keep it being held more or less firmly in place by the fascial layers which so intimately surround the nerve trunk. However all things being equal there can be no objection to using this procedure.

The position maintained will depend not only upon the nerve but also on the level of the lesion. In injuries to the median and musculospiral in the upper arm the arm should be adducted and the forearm acutely flexed; in injuries of the ulnar the arm is adducted and the forearm held extended; in injuries below the elbow to the median the forearm is bent at a right angle and the hand placed in full supination and the same position for the musculospiral except that the hand is held dorsiflexed; in ulnar injuries at the same level the forearm is fully extended and the hand flexed in slight adduction. The sciatic is relaxed by flexion of the knee. Where there are other injuries such as fracture which might lead to more or less permanent deformities it is needless to say that the primary indication is to treat them. For what avails it if when the nerve repair has taken place there is permanent disability due to malunion, contractures or other deformity. The coincident treatment of the case will hardly fall within the scope of this paper.

*Correction of deformity before operation.* Prior to operative interference in nerve injuries all contractures must be overcome. Free mobility of all joints is a *sine qua non* before any operative procedure can be undertaken. Most obstructions to mobility are mechanical, hence even though the nerve should repair, if injury there would remain

definite block to the return of motion. Contractures and adhesions should be stretched gradually. Continuous and gradual stretching is better than daily passive movements. Daily movements when of sufficient force to increase mobility constantly tear the fibrous tissue which in turn sets up new fibroblastic reaction and therefore should be avoided. Gradual overstretching gives less reaction and is more permanent in its effect. In some cases adhesions may be broken up under ether and then by constant stretching continuing the treatment. It must be remembered that in extensive paralysis the bones become brittle consequently adhesions should be broken only by the experienced.

Neuritic contractures are extremely difficult to handle. Increasing the immobility only serves many times to accentuate the deformity, contractures recurring within a few days after removal of the appliances. In such instances daily movements and baths with electricity must be combined with immobilization. The most satisfactory treatment is prevention before the contractures have become marked. In the early stages the muscle groups show an increased hypertonia with beginning tenderness of the muscle bellies and gradual postural deformity which can readily be overcome by passive movements. In the later stages the tenderness becomes very marked and the muscles extremely sensitive to mechanical stimuli. On slightest efforts the muscles are held in extreme contraction almost a tetanic spasm. They finally become rigid and cannot be passively corrected. Mechanical treatment in such cases must be developed in each individual instance. Here the effort is not to prevent definite contractures but rather so to overstretch the muscles that for the time being they lose all power of contraction. Positive splinting combined with contrast and electrical baths will usually be most serviceable.

Mechanical treatment of the more distinct types of peripheral nerve injuries will be treated separately except in those instances in which the associated paralysis may be similarly handled. Combined and multiple peripheral lesions are variable and will require in each case modified types of apparatus.

*Brachial plexus injuries to the fifth and sixth cervical nerves.* Injuries to the brachial plexus are extremely variable in extent depending upon the level of the wound. In general it may be said that those above the clavicle are injuries to the roots and primary cords either single or multiple whereas those below the level of the clavicle and in the axilla include the secondary cords and nerve trunks and are frequently accompanied by trauma to the larger blood vessels. Of all peripheral nerve lesions perhaps none require more efficient and continuous mechanical treatment. The deformity is extensive and the possibility of return of function poor. Particularly is this true when there are marked arterial injuries superimposed upon an already extensive paralysis and introducing an element of ischemic paralysis.

Of the suprascapular injuries there are two main types: the Erb-Duchenne or upper root group involving the fifth and sixth cervical roots; the Aran-Duchenne or lower root group implicating the seventh and first nerves. In the former the resulting paralysis is extensive including the muscles of the shoulder girdle and even those upon the back as well as muscles of the arm and forearm. In the Aran-Duchenne the paralysis is essentially of the ulnar side of the forearm and the muscles of the entire hand.

The muscles involved in paralysis of the fifth and sixth cervical nerves are those of the shoulder girdle: supraspinatus, infraspinatus, subscapularis, teres major, deltoid. If the lesion is close to the exit of the roots from the vertebral canal in addition the major portion of the serratus magnus, rhomboides and levator anguli scapulae may be included.

Those of the arm are the biceps, brachioradialis, brachialis anticus. Those of the forearm are the pronator radii teres, flexor carpi radialis, palmaris longus, supinator brevis. These may be incompletely paralyzed. In those injuries in which the muscles of the back are involved the deformity is extensive because the compensatory movements of the scapula so important in deltoid paralysis are materially lessened if not altogether lost. It will be recalled that by development of the



serratus magnus and trapezius the movements of the scapula may be made to compensate and take on to a considerable degree the movements of the shoulder girdle. Hence in injuries involving the nerves to the serratus magnus rhomboidei and levator anguli scapulae as well as the deltoid and supraspinatus the range of movement left is almost nil. Furthermore the action of the serratus magnus in fixing the scapula is that the deltoid may act is gone—a point which must be borne in mind and the scapula manually supported when the deltoid is being re-educated in the early stages of recovery.

There is complete loss of flexion of the forearm on the arm due to the paralysis of the biceps brachioradialis and brachialis anticus in the forearm in some instances incomplete paralysis of the pronator radii teres flexor carpi ulnaris and palmaris longus and supinator brevis. Thus the deformity is extensive including all the important components of the upper extremity. The arm lies adducted with marked inward rotation due both to the action of the latissimus dorsi pectoralis major and coracobrachialis. The humerus is soon subluxated and in neglected cases completely dislocated. The coracoid process is prominent. The forearm cannot be flexed and is held in empronation. The palm of the hand faces backward due to total inward rotation of the entire extremity. Left to themselves without efficient mechanical appliances there is permanent irreparable deformity. The deltoid suffers most being stretched due to adduction and the unsupported dependent weight of the extremity. This is especially seen in infantile paralysis when not properly splinted in which the permanent loss of power in the deltoid is most marked and the return of function slower so that attempts at retraining are discouraging.

In the deformity about the shoulder there are two distinct postures which must be attained. First abduction to relax the deltoid and the supraspinatus second and the one most overlooked *external rotation*. Quite often the only apparatus used is an axillary pad and a sling or a simple abduction splint. Such measures are inadequate.

The arm must be held in abduction pre-

ferably at an angle of about sixty degrees with the axis of the humerus in the mid coronal plane so as to relax the clavicular and scapular portions of the deltoid. If brought forward beyond the coronal plane neither the deltoid nor the supraspinatus are placed in the most favorable position. Complete abduction to ninety degrees is extremely awkward and in some cases in which there may result permanent deformity it is a position of least service. In addition the arm is overcorrected in external rotation and the forearm flexed upon the arm a little beyond a hundred degrees and held in slight supination so that the hand looks toward the face.

The author's splint here shown has been found satisfactory. There are many other similar appliances however the advantage of this apparatus is that the angle of both abduction and flexion may be altered at will. It is made of an aluminum frame lined with felt consisting of a chest piece of an adjustable arm and forearm piece. The arm piece is hinged and can be altered and held in various angles of flexion. There are three chest straps of canvas two around the chest the third around the opposite shoulder. This last strap may be placed around the same shoulder but it is better to avoid any constriction or pressure on paralyzed muscles. The arm and forearm straps are placed as far as possible over the tendinous parts rather than the muscle bellies. By slight torsion of the forearm piece the degree of supination may be varied. No matter what type of splint is used the arm must be in abduction external rotation and the hand in supination. There are many other splints but this one has proven very serviceable and perhaps has much to commend it.

In injuries involving the last cervical and the first thoracic nerves the paralysis is limited in its manifestation to the ulnar side of the forearm and the muscles of the hand with the exception of the adductor pollicis and the opponens pollicis which receive fibers from the fifth and sixth cervical nerves and hence are not included. The two radial lumbricales escape yet I have never seen in the cases at examination any evidence of their action. In the forearm the flexor carpi

ulnar flexor profundus and sublimus as well as the flexor longus pollicis are paralyzed.

The deformity is slight radial abduction on flexion due to the flexor carpi radialis with loss of all the flexors of the fingers and thumb. The hand is the typical flat hand seen in combined median and ulnar injuries. There may be marked tendency to contracture, marked hypotonia and in neglected cases subluxations of the interphalangeal joints.

A straight splint in line with the forearm with individual grooves for each finger with the fingers in slight abduction offers the most satisfactory mechanical treatment. This type of splint is best made in light material such as paper mache and copied from a mold made for each individual case. The straps should be so placed in so far as is possible so that slight extensor movements of the fingers may be carried on the flexion part being accomplished by gravity. The fingers are raised and allowed to fall to the level of the splint.

*Injuries to the seventh cervical root and musculospiral nerve.* Injuries to the middle primary trunk, the seventh cervical root as well as to the middle secondary trunk result in essentially total paralysis of the musculospiral in which however the action of the brachio radialis is retained (supplied by the fifth and sixth through the musculospiral) thus differentiating the paralysis from the more peripheral type. The deltoid, triceps and extensors of the wrist, fingers and thumb are paralyzed.

The essential deformity is loss of abduction, inability to extend the forearm, the wrist and all the fingers. The arm hangs in abduction usually with very little inward rotation, the forearm slightly flexed and complete wrist drop. Mechanical treatment should endeavor to relax the deltoid and overcome the result of gravity upon the extensors. The arm should be held in abduction with the forearm slightly flexed and the wrist dorsiflexed to about fifty degrees. The author's splint shown here for this paralysis is similar to the appliance for paralysis of the fifth and sixth roots. Due to the anatomical arrangement of the triceps this muscle is not apt to be overstretched. However on account of gravity and adaptive shortening of the

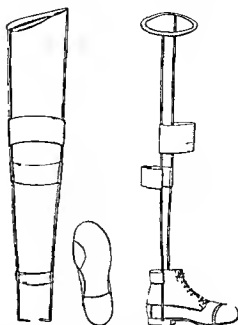


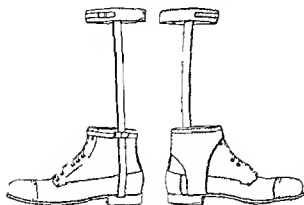
Fig. 4. Thomas caliper for paralysis of anterior crural nerve. Not an ideal high caliper should be inserted into shoe so as to obtain light extension of foot. The shoe is elevated on inner border so as to elevate body eight and lessen the strain on knee joint. A spring lock may be used to permit flexion on sitting.

Fig. 5 (at right). Thomas caliper for total paralysis of the brachio radialis. The iron and steel plate to maintain the foot in high dorsiflexed and pronated position.

flexors, the extensors of the fingers and wrist undergo marked regressive changes unless properly splinted.

In paralysis of the musculospiral below the circumflex there is complete paralysis of the brachioradialis and usually partial paralysis of the triceps. The branches to the long head of the triceps come off fairly high, hence at least one head is apt to escape but the extensors of the wrist and all fingers are thrown out with subsequent wrist drop. Untreated the postural deformity gradually increases, the wrist falls almost to a right angle due to gravity and extreme atony combined with the unopposed action of the flexors. Subluxation about the carpus may occur and edema is frequent.

Correction of the deformity consists in preventing wrist drop. Even after successful repair of the nerve, return of motor function is immeasurably delayed unless overstretching is prevented. To accomplish this there are numerous appliances to maintain the wrist and first phalanges in a dorsiflexed position. There is no need to elevate the second and



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third phalanges since extension is accomplished by the interossei acting upon the extensor tendons. To obtain the optimum relaxation the wrist should be elevated to about fifty degrees. All splints should include the thumb since the extensors to the thumb are also implicated.

Appliances which hold the wrist straight and in line with the forearm are not efficient and do not prevent overstretching. Most of them seek to replace the action of the extensor tendons by using rubber tubes or flexible metal bars. These are very convenient and so far as motion is concerned satisfactory in that they permit the patient to make excellent use of his hand. However the wrist must first be elevated to at least fifty degrees and the range of motion supplied from that angle. Splints which are dorsally placed by leaving the palm unobstructed are more satisfactory and permit of greater use of the hand—a by no means negligible consideration.

**Musculocutaneous.** Injuries to the musculocutaneous destroy the nerve supply to the biceps, brachialis anticus and coraco brachialis. Normally there is a slight supply to the brachialis anticus from the musculospiral but rarely sufficient to permit of a functional contraction. The first two mentioned are the principal flexors of the forearm though this movement is not completely lost due to the compensatory action of the brachioradialis

which may produce forcible flexion of the forearm upon the arm. However the forearm usually can *not* be flexed if the arm is made to hang by the side in full extension and in supination. Generally when seated for examination the patient will attempt to place his hand upon his thigh and thus with the forearm slightly bent the brachioradialis will be able to flex with considerable force. This action may be rendered more difficult and in not a few impossible if the hand is placed in full supination. When the hand is in full pronation the brachioradialis may in its contraction to produce supination gain slight leverage and thus obtain further contraction in the direction of flexion. Occasionally in testing with the arm hanging the patient will begin to swing the extremity back and forth and on an upstroke the brachioradialis may find sufficient leverage to complete flexion.

There is very little mechanically indicated for this paralysis since there is very little overstretching. Stimulation of the triceps produces greater extension due to lack of influence particularly of the brachialis anticus in limiting this movement. By reason of the bony shape of the joint there is little deformity—the olecranon process meeting bony resistance against the olecranon fossa. The action of the brachioradialis should be developed by frequent and graded exercises thus maintaining a free range of motion. To prevent overstretching in attempts to carry weights etc. and to limit other unguarded movements the arm is held in flexion with the hand in supination and the arm drawn forward in the direction of the opposite shoulder. A broad leather cuff with either a collar piece or a pin and snap to fasten to the garment will suffice to maintain this position satisfactorily. The wrist strap includes a metal extension running forward across the dorsum of the hand and wrist serving as a support for the hand and preventing it from falling into a dependent position. Unless this support is used the patient will find the attitude uncomfortable and in order to correct it will attempt to pronate the hand on to the chest and make the chest serve as a support. A dorsal extension piece makes the fully supinated position both easier to maintain

and more comfortable. The small support strap which is attached only on the volar surface of the radius passes over the radius on to the dorsum of the hand and thus tends to hold the hand in the supinated position.

**Ulnar nerve.** The clinical manifestations of ulnar nerve injuries are extremely variable due to the large number of muscles supplied to their rather antagonistic action and to the variability of supply. Furthermore the clinical type varies materially according to the level of the lesion, i.e. whether above or below the supply of the profundus.

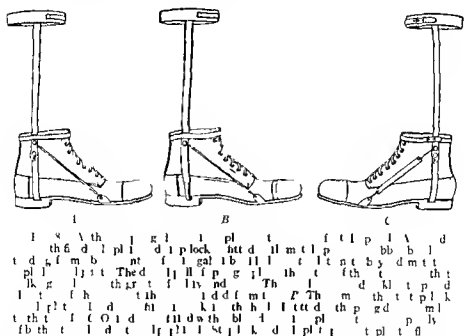
In complete paralysis the hand becomes soft and flexible because of loss of support to the arches by atrophy of all muscles of the hand and relaxation of the ligaments. Subluxation of the metacarpophalangeal joints occurs as a result of the unopposed action of the extensor tendons of these joints. The fifth, fourth and third fingers to a less extent are held in semi flexion occasionally when the ulnar sends twigs to all the profundus heads the third and second fingers are flexed due to the unopposed action of the flexor sublimus and the loss of extension performed by the interossei. When the profundus is not included in the paralysis the deformity becomes more marked since the distal phalanx is acutely bent.

Usually in a complete lesion there is very little contracture. However in nearly every case I have seen there have been fibrous adhesions and very definite limitation to the joints of the middle and proximal phalanges especially of the fifth and fourth fingers so that complete extension becomes impossible. In the neuritic type there are very marked adhesions and dense scar tissue leading many times to irreparable deformity in spite of treatment. Great care must be taken in the mechanical treatment of both types. Immobilization may prevent contractures and in the neuritic type produce them. Yet without immobilization contractures are certain to appear. Immobilization alone or mobilization alone does not prevent contractures. *Efficient immobilization must be combined with efficient mobilization.* All movements should be regularly performed and the periods of repose guarded by apparatus.



Fig. 1. Caliper for paralysis of external popliteal (A) (left). Inside iron with fixed sole plate and stop lock to prevent toe drop and yet permit flexion of the ankle. Foot held slightly dorsiflexed to give greater facility in walking. B. The same outside elevation of sole and heel and outside ankle strap to prevent tarsus deformity.

In the simpler cases straight splints suffice whereas in the neuritic the principal contractures must be rigorously overcome by overcorrection. For the complete lesion a simple straight palmar splint with individual gutters for each finger with the fingers in slight adduction will offer the best mechanical treatment. In the milder cases a two finger splint for the fifth and fourth fingers extending across the palm to the thenar eminence thence across the wrist and forearm will be sufficient. In the contractures of neuritic origin the deformities are most varied. Usually the fifth and fourth fingers and partially the third are rigid in flexion and the deformity is increased by fibrosis of the palmar fascia very like the changes in the fascia in Dupuytren's contracture. Such deformities become fixed and irreparable even after nerve repair may have taken place. The principle of splinting in these cases must be to overcorrect the tendency to deformity during the period of repose and immobilization should always be combined in these cases with active and passive movements. A straight splint including the hand dorsiflexed to an angle of forty to fifty degrees will be found serviceable. There should be separate grooves for each finger and each finger should be held in slight adduction so as to prevent overaction of the interossei. From time to time the angle of dorsiflexion should



be increased. Passive movement and active movements must be repeatedly done and the patient made to try to use each muscle group during the period of exercise.

**Median nerve.** By laceration of the median nerve there is paralysis of the flexors of the wrist, second and third fingers and thumb, loss of both pronators, though pronation may still persist in some cases on account of the action of the brachioradialis and if a paralysis of the abductor and opponens of the thumb.

The forearm lies in supination. Occasionally the brachioradialis may perform both supination and pronation depending on its point of insertion in the base of the styloid process of the radius. For the same reason according to whether its insertion lies more anterior or posterior to the median line it may be either a supinator alone or a pronator. Flexion at the wrist is still accomplished by the flexor carpi ulnaris. In the effort to flex there is marked adduction because the synergic action of the flexor carpi radialis is wanting. There may also be slight flexion of the thumb due to the deep head of the flexor brevis pollicis supplied by the ulnar. Flexion of the proximal phalanges may still take place by means of the interossei. Frequently the

ulnar also supplies the slip to the third finger hence flexion of this finger may be present.

Contractures are rather rare. When they do occur there is partial flexion of the thumb and second and third fingers with slight tendency to contraction of the palmar fascia. The distal phalangeal joints of the second and third fingers tend to become fixed in slight hyperextension.

A straight splint with light flexion for the distal phalanx made after a plaster model with separate grooves for each finger will offer sufficient mechanical support. The splint need not extend in the palm any further than the hypothenar eminence and thence across the wrist on to the forearm. This position does not allow complete relaxation or complete overcorrection. The overcorrected position of the flexors occurs only with the wrist dorsiflexed to about twenty degrees since with flexor contraction there is synergistic extension of the wrist, e.g. in all attempts to grasp there is coincident extension of the wrist. Hence the straight splint by assuming about the mid position offers sufficient relaxation and prevents the more usual deformities in the neuritic types. These are rarely severe. In severe types the fully extended position may then be used.

In combined median and ulnar injuries both pronators all flexors of the wrist fingers and thumb as well as the intrinsic muscles of the hand are paralyzed. The hand is flat and there is marked relaxation of all articulations frequently with subluxations of the metacarpal phalangeal joints. These are many times held in extreme dorsal flexion by the action of the unopposed extensors. When contractures occur the usual deformity is acute flexion of the distal phalanges of the last four fingers and flexion of the thumb. The type of splint to be used was referred to in paralysis of the lower brachial plexus roots.

The patient may be able to flex the fingers with the hand in pronation by quick extension of the wrist followed by sudden relaxation. A purely mechanical recoil occurs with slight flexion of the fingers. Some patients may accomplish this with the hand in supination. A few develop also flexion of the wrist by associated action of the extensors which may lead if a careful examination is not made to an erroneous mechanical conception of the muscles paralyzed.

**Anterior crural.** Severance of the anterior crural is most uncommon and is usually associated with injury to the pelvis and great vessels. There is paralysis of the quadriceps extensors sartorius and pectineus with inability to extend the leg upon the thigh or to stand on the leg except when the knee is held in extreme extension. Unless carefully guarded the knee becomes a true trigger joint suddenly giving away and letting the patient down. In walking the body is bent forward the hand resting on the anterior surface of the thigh or due to the action of the tensor fascia lata the leg is locked in hyperextension and a swinging gut is assumed.

Contractures are uncommon however in older cases genu recurvatum is very prone to occur due to constant fixation of the knee in hyperextension. In neglected cases posterior subluxations of the tibia upon the femur may develop.

Mechanical support should offer stability to the knee and prevent hyperextension. This can readily be accomplished by the Thomas walking caliper fitted with either a stop or spring lock permitting flexion of not more



FIG. 10. Caliper for paralysis of internal popliteal (at left). Outside of iron and sole plate with lever and stop lock thus permitting for flexion and preventing calane deformity. B. Side view illustrate hinge of ankle strap and projection for elevation of sole and heel.

than thirty five degrees. The spring lock gives considerable comfort since in sitting it permits the knee to be slightly flexed and by limiting the degree of flexion overstretching of the extensors will be avoided. A broad strap placed behind the knee will prevent hyperextension and the occurrence of genu recurvatum.

With the support of the quadriceps gone strain on the knee joint is very apt to occur and should be guarded against. By altering the relative position of the external and internal bars of the caliper as they fit into the heel the foot may be thrown into slight eversion or inversion. The position of inversion throws less strain upon the knee joint and the internal lateral ligament and is the position to be preferred in paralysis of the anterior crural nerve.

**Sciatic nerve injuries.** Total paralysis of the sciatic is extremely rare. Of sciatic injuries the external popliteal portion is most frequently involved. This peculiar vulnerability of the external popliteal has been the observation of surgeons in the Russo Japanese war the Balkan wars and in the present war. The susceptibility is not only peripheral but central as well being frequent in neuritis of toxic origin such as alcoholic diphtheria etc. In complete severance high up even at the level of the gluteal fold total sciatic paralysis does not occur due to the fact that the muscular bundles to the long head of the

biceps and semi tendinosus come off from the nerve in separate bundles at the level of the tuber ischi. Hence these two muscles are rarely included in paralysis of the cratic. The semi tendinosus escapes more often than the long head of the biceps. It is capable of performing to a remarkable degree the function of all the other ham strings as well as the flexion action of the leg on the thigh of the gastrocnemius. Such cases when fitted with suitable appliances show relatively little impairment of function. In fact one case of combined cratic and anterior crural paralysis in which the semi tendinosus was saved was able to walk when fitted with suitable mechanical support without much inconvenience due to the compensatory development of the flexor and extensors of the thigh on the trunk.

In total sciatic paralysis all muscle below the knee are thrown out. The foot hangs flaccid dangling a dependent member. Due to the gravity and the total atonia of all muscles there is complete foot drop. There is also either varus or valgus deformity together with acute flat foot. This latter complication is often overlooked. On account of the anæsthesia there are no painful symptoms. Nevertheless the condition requires careful consideration in the plan of treatment.

The aim of proper mechanical correction is to give to the lower leg and foot stability to correct postural deformity to overcome faulty deviation of the body weight and to lend support to the relaxed arches of the foot. Unless all these factors are taken into consideration the mechanical treatment will be inefficient and only partially of value.

Probably one of the most satisfactory appliances is a modified Thomas caliper permitting flexion at the knee of forty five degrees. This apparatus is light comfortable and extremely servicable. There are many splints heavier and more cumbersome but not more efficient. In place of a stop lock a spring lock may be used. The patient walking stiff legged and upon sitting is then able to release the lock and bend the knee. The caliper is fixed to a sole plate which extends from the heel to the metatarsal phalangeal joint thus preventing toe drop and calcaneus

deformity. The upright is so fixed to the sole plate that it maintains the foot slightly dorsiflexed. A reinforcement should be sewed on the inside of the shoe and the sole and the heel raised a third of an inch on the inner border to prevent valgus deformity and offer additional support to the weakened arches of the foot by deviating body weight. In total sciatic paralysis is lower down involving both internal and external popliteal branches a plant similar to the one in the diagram will be found extremely serviceable. An outside fixed iron with stop lock to prevent valgus deformity plantar flexion together with a spring arrangement to overcome toe drop and assist in the elevation of the foot makes a very light and efficient appliance. Walking up and down stairs is particularly rendered easier if the foot is held in this position.

It is extremely discouraging when motor power does return to have imposed upon an already existing deformity an additional postural deformity which might have been anticipated and corrected.

*External popliteal.* The anterior and lateral muscle groups of the leg are paralyzed in injuries to the external popliteal. There is complete toe drop and a tendency to varus deformity and in neglected cases equinovarus. Dorsal elevation of the os calcis is marked due to the unopposed action of the muscles of the calf they being normally about five times more powerful than the extensor group. Subluxations may be present in untreated cases. Flat foot occurs due to the loss of support by the peronei and the extensor group to the arches the former supporting both arches and the latter the inner. The gait is very awkward due to increased flexion at the knee in order to clear the toes from the floor. It is particularly noticeable in attempting to walk up hill or up stairs.

In treating this paralysis it is obvious that more should be done than simply to correct the toe drop. A fixed inside iron furnished with a stop lock to prevent plantar flexion will correct toe drop and also the tendency to varus deformity. An outside leather support should be sewed to the shoe to give support to the ankle. The shoe should be elevated on the

outer border both on the sole and on the heel and thereby deviate the body weight on to the inside of the foot and thus tend to correct the varus position. Flat foot should be supported by an inside plate similar to the one described under internal popliteal. The patient should be cautioned not to walk at all not even to the bath room without wearing a proper shoe. The body weight must be properly supported at all times. Most appliances used in this paralysis attempt to correct but one of the deformities namely the toe drop and ignore the other equally important deformities. The spring shoulder strap of M. M. Marie and Meigs corrects nothing more than the toe drop and does not assist in the correction of the associated deformities. The same may be said of the metal spring devices of M. Leri which passes up the front of the shoe. Therefore these appliances seem to be inefficient and should not be used. The author's spring appliance here illustrated not only corrects mechanically the associated deformities but also tends to replace the action of the extensors. An inside iron with a stop lock may be used with the stop lock so placed as to prevent plantar flexion and the fixed iron to hold the foot slightly dorsiflexed. Either a metal spring or rubber band is attached to the shoe at or just beyond the metatarsophalangeal joint and on to the up right inside iron above the level of the center of the astragalo tibio fibular articulation thus giving to the spring or rubber band an adequate anteroposterior pull. Any slight tendency toward inversion in the pull is prevented by means of the fixed iron outside strap and elevation of the shoe. About as useful is an inside iron without a stop lock, the iron being rounded at the end and made so as to fit into a socket in the heel of the shoe the rubber band or spring preventing foot drop. However of the two appliances the former with the stop lock is to be preferred.

*Internal popliteal* In injuries of the internal popliteal there is paralysis of all the muscles of the calf and sole of the foot with loss of flexion of the toes abduction and adduction as well as plantar flexion of the foot. The walk is unsteady the step is heavy

and inelastic the weight falling entirely upon the heel. Due to the unopposed action of the dorsal flexors the posterior surface of the os calcis tends to look down in place of backward. The arch is slightly more concave depending upon the activity of the tibialis anticus and the extensor group etc. There is usually valgus deformity due to the unopposed action of the peronei and also flat foot with particular loss of the inner arch due to paralysis of the tibialis posticus and the small muscles of the sole. Proper mechanical support should attempt to prevent dorsiflexion calcaneus deformity and the tendency to valgus posture. In addition support must be given to the plantar arches. An outside iron with stop lock to prevent dorsiflexion beyond a little more than a right angle will correct dorsiflexion and calcaneus deformity. A slight bend to the side bar together with an inside leather support sewed to the shoe as well as raising the inner border of the sole and heel will both deviate body weight to the mechanically stronger outer arch and correct the tendency to valgus. Inside the shoe an arch plate should be worn to strengthen and offer support to the arches. At night there should be worn a right angle splint similar to the usual one used for club foot.

*Flat foot* In all paralysis of the sciatic the internal popliteal and external popliteal there is a weakening of the arches of the foot and in most instances complete flat foot. Perhaps the inside metal arch brace could not be more clearly indicated than in this class of flat foot and yet in very few are they employed because as long as the paralysis and loss of sensation persist there are practically no painful indications of the condition. Most appliances seek merely to overcome the drop foot and ignore the remaining deformities which are of almost equal importance. A plaster cast or a molded imprint from dental wax should be taken and a steel plate made. Great care must be used since if not properly fitted pressure sores may develop. However with slight precaution these can be avoided.

The patient should be instructed not to get up and about without the proper shoe and brace. One single indiscretion of this sort



may undo months of careful splinting and mechanical treatment

*The electricity massage and baths* No treatment of peripheral nerve injuries would be complete unless it includes electricity massage and baths. The galvanic current is most serviceable and should be employed to make each group of paralyzed muscles contract daily. The faradic current is especially helpful in the early cases of regeneration when slight muscular contraction has returned. All forms of massage should be tried according to the type of case. Contrast baths are very excellent particularly where there is much scurritousness. These forms of treatment all tend to improve the nutrition, prevent degenerative changes in the tissue, maintain muscle contractility and serve to lessen pain. Therefore they are of extreme importance and should be given with regularity in conjunction with passive motion and muscle training.

*Reduction and passive motion* During the entire period of paralysis careful and guarded passive motion should be done, putting each muscle group through its normal though somewhat restricted range so as to avoid overstretching. The movements at first should always be under the guidance of the surgeon. Later on after the patient has been shown the proper motions and the range through which he may exercise his muscles he may be permitted to do the exercises alone. A practical point for the military surgeon handling number of like injuries is to arrange them into groups according to injury and progress of the case and place them in charge of one of the wounded, either a sergeant or a corporal and have the group go through their exercises as a unit. Definite counts should be used for each movement as in setting up exercises. A definite time can be given and a set of exercises gradually and properly graded for each group. If a case which is visibly recovering be placed in the group there will be considerable stimulation and encouragement to the others. There develops also a certain amount of rivalry and amusement which helps to make a monotonous task something of a diversion. Passive motion should be followed by massage and contrast bathing. In place of massage a rubber ball

on the end of a stick and short rapid strokes delivered over the part by the patient may serve as well. This method of percussion massage is of much help. Thus a given group may be put through passive movements, massage and contrast bathing under the guidance of the surgeon or masseur, etc.

Passive movements such as flexion and extension exert a mechanical influence on the flow of blood and lymph and thereby help to improve the nutrition of the part. Passive movements furthermore insure the maintenance of the range of motion and prevent the formation of contractures. In the early stages of recovery there is great need for constant effort at re-education and muscle training of all the paralyzed muscles. This is especially true in nerve injuries since it is rarely ever that the same funiculi are united at operation. Not only must the new axes form new end plates perhaps in another muscle but also new cell groups in the anterior horns and higher centers must compensate and rearrange their function in view of the new termination of their axes into new muscle group.

Each muscle should be put through carefully selected exercises. At first the movements are done passively with the assistance of the surgeon and with the concentration of the patient's effort. A given movement is ordered by the surgeon and the patient the surgeon assisting manually in the performance of the movement. All patients must be made to realize that they can succeed and must center every effort to that end. The assistance of the surgeon is gradually lessened as the regeneration progresses until the exercises are done against gravity and finally against resistance. All movements must be carefully guarded and care must be taken not to overdo muscles which are readily fatigued.

There is no more important factor in the ultimate recovery of many of these cases than their own attitude toward recovery. Many find that by wearing an appliance the disability is comparatively small and become content and resigned to some form of apparatus. It must be made constantly clear to them that such splints are purely temporary — an aid to cure and not a substitute. It is even advi-

able from time to time to change the type of splint. One of the ends of muscle training is to train the will and give definite encouragement. Successful treatment cannot be fully accomplished unless co-operation is gained. Hence the patient should be taken into the confidence of the surgeon and the nature of his injury explained and wherein it differs from other injuries. A figure I often use is to explain that when a nerve is cut the nerve fibers must grow out from the center and the nerve requires time just as hair would take to grow so great a distance. Furthermore treating the patients in groups which are arranged according to the injury tends to lend encouragement particularly if a case which shows obvious improvement is placed among them.

Their time should be occupied and the morale must be sustained. This can be accomplished partly by employing all men in a curative work shop and giving them some form of work. In this way they are made to feel that they are accomplishing something and their minds are taken off of their own convalescence. Many types of employment can be given to a case of nerve injury since they rarely have lost more than the use of one arm or leg and consequently are capable in many instances of doing full time duty. However their work as well as other forms of treatment should at all times be under the constant guidance of the surgeon.

I wish to express my gratitude to Dr. Huber for his very keen interest and many valuable suggestions.

## THE NEED AND VALUE OF BIOPATHOLOGICAL STANDARDIZATION<sup>1</sup>

BY WILLIAM CARPENTER MACCARTY, M.D. ROCHESTER, MINNESOTA

IN reviewing the present status of tissue pathology and its terminology in relation to clinical medicine it seems that there has been a stationary period of about twenty years in which it has not rendered the greatest degree of efficiency.

It is possible that this period of quiet had its origin in the fact that tissue pathologists were dealing with end results as seen at necropsy plus postmortem changes and the imperfections of methods of fixation all of which probably misrepresent the facts as they exist during life. The resultant conception made upon both pathologists and clinicians is somewhat comparable to that obtained in the study of systematic botany from dried pressed specimens as compared with that derived from growing specimens in the field or the conception of birds which is derived from stuffed skins. Such artificial and unnatural methods of study however certainly have their places in science and should not be condemned. Without them we should never have reached our present knowledge but their usefulness as makeshifts

is losing its value in the presence of newer methods and observations in pathology, clinical medicine and general biology.

The second probable reason for the quiet of investigation in tissue pathology may be the fact that bacteriology with its closely related sciences such as immunology and serology has made its greatest advances during the last twenty five years and has drawn men of vision imagination and initiative away from tissue pathology.

The pupils of such great teachers of tissue pathology as Virchow, Cohnheim, Ribbert, Rokitsky, Chiara, Orth, Borst, Welch, Councilman, Hektoen, Leconte, MacCallum, Adams and others have become immunologists, bacteriologists, serologists, sanitarians and cancer experts.

The field of tissue pathology has been practically deserted. Hospitals and teaching institutions are beginning to realize the great dearth of efficient men to carry on tissue investigations for clinical diagnostic purposes which they realize are absolutely necessary for efficient medical and surgical practice.

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*The electricity massage and baths* No treatment of peripheral nerve injuries would be complete unless it includes electricity massage and bath. The galvanic current is most serviceable and should be employed to make each group of paralyzed muscles contract daily. The faradic current is especially helpful in the early cases of regeneration when light muscular contraction has returned. All forms of massage should be tried according to the type of case. Contrast baths are very excellent particularly where there is much scar tissue. The different forms of treatment all tend to improve the nutrition, prevent degenerative changes in the tissue, maintain muscle contractility and serve to lessen pain. Therefore they are of extreme importance and should be given with regularity in conjunction with passive motion and muscle training.

*Education and passive motion* During the entire period of paralysis careful and guarded passive motion should be done, putting each muscle group through its normal though somewhat restricted range so as to avoid overstretching. The movements at first should always be under the guidance of the surgeon. Later, when the patient has been shown the proper motion and the rings through which he may exercise his muscles, he may be permitted to do the exercises alone. A practical point for the military surgeon handling numbers of like injuries is to arrange them into groups according to injury and progress of the case and place them in charge of one of the wounded, either a sergeant or a corporal and have the group go through their exercises as a class. Definite counts should be used for each movement as in setting up exercises. A definite time can be given and a set of exercises gradually and properly graded for each group. If a case which is visibly recovering be placed in the group there will be considerable stimulation and encouragement to the other. There develops also a certain amount of rivalry and amusement which helps to make a monotonous task something of a diversion. Passive motion should be followed by massage and contrast bathing. In place of massage a rubber ball

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be it one inch or three feet thick is the practical line of demarcation and so it is in pathology there is a practical histological biological and clinical line which was first described before this society in 1908 ( ) Coincidentally with this description a new observation was made relative to the role played by regeneration in the life history of tissues and the recognition of the process of regeneration as a protective process of cells against an antagonistic environment

It was later recognized that this reaction of cells is similar to the protective activities of all living matter

It was seen that during the structural and functional evolution of multicellular organisms certain phenomena occurred Specialization and differentiation of cells were coincident with a diminution of power of reproductivity which in order to preserve such cells or tissues in the presence of constant or periodic destruction must of necessity be carried on by reserve cells the function of which is tissue reproduction

The reactions of these reserve cells (toblasts) represent histologically hypertrophy hyperplasia and migration which biologically mean hyperactivity reproduction and change of environment and clinically mean benignancy an indeterminate condition and malignancy There is one other phenomenon which is of significance in association with hyperplasia that is attempt at tissue differentiation which sometimes occurs in the expansive and migratory conditions of hyperplasia It is well known that the so called malignant cells (migratory hyperplasia) attempt differentiation when they arrive in an environment which is favorable to such a change (3)

It is the lack of this phenomenon in the so called indeterminate stage which prevents the expert microscopist from prophesying clinically just what will occur How can he read in undifferentiated cells of living structures just what they intend to do?

It is this stage which has produced confusion among pathologists and has caused some to call certain conditions malignant and some to call them benign It is the stage of cytologic activity which makes the differentiation

of some chronic inflammatory conditions from malignant conditions difficult in fact impossible

It is the biological significance and importance of regeneration with its stages which the pathologists who were dealing with dead tissues and end results failed to recognize

It is well known that all but a few tissues are capable of regeneration and in the case of most tissues the reserve cells are recognizable

The regenerative neoplastic conditions were originally described in the following terminology (4)

Primary (restau o) (be ign)	adeno cardiomyo chondro endothelio erythro	melano myo neuro osteo	} cytoplasia or neoplasia
Second y (expando) ( )	fibro glio	erithelio fil	
Tertiary (migr) (malignant)	leiomyo leuco lipo lympho	poly rhabdomyo- etc	

This conception has been and is applied efficiently to tissue diagnosis from a clinical standpoint

Although it is applicable to regeneration and neoplasia it is not representative of all the visible biological phenomena which occur in tissue reaction and is not therefore complete from the standpoint of either the clinician or pathologist although it has formed a basis for study correlation and description of all of the other phenomena

There are six fundamental reactions to antagonists which manifest themselves microscopically or macroscopically

- 1 Cytolysis
- 2 Atrophy
- 3 Hypertrophy
- 4 Neoplasia
- 5 Differentiation
- 6 Inflammation

There are seven conditions involved in the basis of the newer conception of pathology and its terminology

- 1 Type of cell
- 2 Normal activities of cells
- 3 Biological reaction of cells to antagonists in their environment

The following facts are examples of the necessity of expert microscopic tissue diagnosis to the clinician surgeon and pathologist

#### I FROM A CLINICAL STANDPOINT

T	t	l	ml	r	i	l	i	n	j	i	9	475
T	t	l	ml	f	p	t						699
T	t	l	ml	f		l	l	m				46
T	t	l	ml	f	i	m	r	m	l	f	l	79
T	t	l	ml	i					p	l		5
P	t		t	l	l		i	t	d	i		3
P	t		t	l	l						h	l
P	t		t	l	l		p	l		p	m	f
P	d											3
P	d		t	l	l		h	h	d	m	p	43

#### II FROM A SURGICAL STANDPOINT

T	t	l	n	ml	f		h	l	l	j	i	9	475
T	t	l	ml	t	i	r	t						699
T	t	l	ml	t			l	e	m				46
T	t	l	ml	t						l	l	h	9
T	t	l	ml	t						i	d	g	8
P	t	g	t	f	i	t		h	h	l	i	m	6
P	t	g	t	f	i	t		h	h	l	i	m	

#### III FROM A PATHOLOGICAL STANDPOINT

T	t	l	ml	t		g	t	l	j	h	19	4
T	t	l	ml	f	p	t						699
T	t	l	ml	f	g	l	l	m				46
T	t	l	mb	f		m	m		j	l	h	9
T	t	l	mb	f	i	m	m		d	f	l	79
T	t	l	mb	f	i				l	f	l	g
i			t	f								49
i	m		t	f	d	h						98
i	m		t	f	d	h						83

#### IV PERCENTAGE RECKONED WITHOUT APPENDICES (ALL BLADDERS AND OVARIES)

T	t	l	l	f		l	p	m				46
T	t	l	mb	f	i	p	d	g	l	l	l	3
T	t	l	mb	f				p	m	m	l	
p	i		h	l	l	l						75
T	t	l	ml	h	l	l	l	l	l	l	l	7
i	l	g	f			y	m	o	p	l	l	8

The figures clearly indicate that clinical medicine needs tissue experts in order to render efficiency to the patient

Many clinicians and surgeons have the impression that they can make their own pathological diagnoses but this is but an impression which is rarely if ever corrected by them statistically. Such impressions must be filled with error in the light of the fact that tissue experts with very extensive experience can diagnose only about 75 per cent

of all specimens grossly and if they rely upon old standards of microscopic diagnosis they find themselves face to face with a possibility of microscopic diagnosis in only about 95 per cent

The clinician's clinical diagnostic error is usually thought of as being about 5 per cent. As a matter of fact in such a superficial organ as the mammary gland his actual error is from 2 per cent to 6 per cent when he makes positive diagnoses. His apparent error by which is meant that error in pathological terminology which does not affect the patient is 8 to 50 per cent.

His natural acuity and honesty have led him to avoid clinical error in from 1 to 57 per cent of different mammary conditions by utilizing such terms as tumor nodule mass growth benign (?) malignant (?) or by making no diagnosis.

When he utilizes such a term as carcinoma ( ) for example which he does in 8 per cent of his cases (1800) his guess is correct in 57 per cent (r).

These figures represent the condition of diagnostic efficiency in one organ which compares favorably with his efficiency in the diagnosis of many conditions in other portions of the body which will be published at some future date.

The main factor in which the writer is especially interested at this time however is the terminological inefficiency represented by the clinician's attempt to utilize detailed pathologic terminology for clinical purposes. His code of communication of ideas has an inefficiency of from 1 to 57 per cent which is too large to be scientific although when utilized with the help of tissue pathologists it may not prove inefficient in so far as the patient is concerned because what the clinician and surgeon really want to know in the breast for example is whether the condition is benign or malignant operable inoperable or nonoperative. Clinicians have been led to believe however by pathologists that conditions are either benign or malignant which is only theoretically true.

The theoretical line of demarcation is similar to the one dividing two pieces of property it has never been seen. The fence

which gives a plastic but definite terminological key to most of the pathologic conditions which we find in tissues

The clinician can recognize positively only those conditions which are italicized in Table II although he might possibly recognize some of the conditions in columns 1 and 2

Time does not permit a detailed elucidation with examples of the application of this conception. Although perhaps not yet perfect and complete it offers a simple conception with a simple code of communication it is histologically clinically biologically and scientifically more efficient than the chaotic extravagant inconsistent empirical and clinically inefficient conception and terminology of tissue pathology which has come down to us from that great and essential period of observation and description which shall ever be remembered in association with the great masters of pathology who had a scientific

strength of conviction which was great enough to break away from the mystic empiricism of the ages which had preceded them

In conclusion it must be stated in the presence of this body of progressive surgeons of America that this new conception as it exists was not possible without a study of early conditions and processes which was made possible by what might be called prophylactic operative surgery as it is being practiced in association with expert microscopy

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- 4 The degree of reaction of cells
- 5 The gross tissue manifestations of cellular reaction
- 6 The duration of reaction
- 7 The antagonists which caused the reaction
- 8 There are at least 8 different kinds of cells which form human differentiated tissues which constitutes the human organism

l t	h t	m l	p lo-
d	gl	m	p ly
f m	t	my	b l d
h l	l my		b
l th l	l	d	t t l
r t l	l p	t	t t
t	lymph	l th l	

Cyt (3)

There are three degrees for each reaction  
Cytolysis

- 1 Destruction of the cellular wall
- 2 Destruction of the cellular wall and destruction of the nuclear wall
- 3 Destruction of the whole cell

Atrophy

- 1 Reduction of the cytoplasm
- 2 Reduction of the cytoplasm and nuclear plasma
- 3 Reduction of the whole cell

Hypertrophy

- 1 Increase in size of the cytoplasm
- 2 Increase in size of the cytoplasm and nuclear plasma
- 3 Increase in size of the whole cell

Neoplasia

- 1 Hypertrophy of regenerative cells plus presence of differentiated cells

- 2 Hyperplasia of regenerative cells plus absence of differentiated cells with or without partial differentiation
- 3 Hyperplasia of regenerative cells plus migration with or without partial differentiation

Differentiation

- 1 Partial grouping of cells according to normal grouping  
Incomplete normal morphology of tissue cells
- 3 Complete normal grouping and normal morphology of tissue cells

Inflammation

- 1 The cardinal signs of inflammation (rubor tumor calor and dolor)  
Rubor tumor calor and dolor plus ulceration
- 3 Rubor tumor calor and dolor plus pus  
The biological reactions sometimes manifest themselves grossly as

- |                    |              |
|--------------------|--------------|
| 1 Circumscribed    | } conditions |
| 2 Noncircumscribed |              |
| 3 Papillary        |              |
| 4 Polypoid         |              |
| 5 Cystic           |              |
| 6 Ulcerated        |              |

They occur in relation to time as

- |           |              |
|-----------|--------------|
| 1 Acute   | } conditions |
| 2 Chronic |              |

If these facts be correlated they arrange themselves in the manner shown in Table I

TABLE I

Ac t	<table> <tr><td>m</td><td>nb d</td></tr> <tr><td>l</td><td>m nb d</td></tr> <tr><td>l</td><td>lia y</td></tr> <tr><td>l</td><td>p d</td></tr> <tr><td>t</td><td></td></tr> <tr><td>l</td><td>t d</td></tr> </table>	m	nb d	l	m nb d	l	lia y	l	p d	t		l	t d	<table> <tr><td>prim ry</td><td>d y</td></tr> <tr><td>t t y</td><td></td></tr> </table>	prim ry	d y	t t y		<table> <tr><td>d to-</td><td>fib o-</td><td>m l o-</td><td>p l</td></tr> <tr><td>d o-</td><td>gl o-</td><td>my o-</td><td>p ly</td></tr> <tr><td>di myo-</td><td>t to-</td><td>my</td><td>h bdo-</td></tr> <tr><td>h d o-</td><td>l myo-</td><td></td><td>b</td></tr> <tr><td>d th lo-</td><td>l</td><td>d</td><td>t t lo-</td></tr> <tr><td>p th lo-</td><td>lpo-</td><td>t</td><td>t d</td></tr> <tr><td>ry th</td><td>lympho</td><td>ie th l</td><td></td></tr> </table>	d to-	fib o-	m l o-	p l	d o-	gl o-	my o-	p ly	di myo-	t to-	my	h bdo-	h d o-	l myo-		b	d th lo-	l	d	t t lo-	p th lo-	lpo-	t	t d	ry th	lympho	ie th l		<table> <tr><td>yt ly</td></tr> <tr><td>t phy</td></tr> <tr><td>hyp rt ophy</td></tr> <tr><td>pl</td></tr> <tr><td>d ff t at o</td></tr> <tr><td>fl mm t</td></tr> </table>	yt ly	t phy	hyp rt ophy	pl	d ff t at o	fl mm t
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TABLE II

A t Ch	$\left. \begin{array}{l} p \text{ } p l l \text{ } y \\ p \text{ } l y p \text{ } d \\ t \text{ } t \text{ } d \end{array} \right\}$	$\left. \begin{array}{l} p \text{ } m \text{ } r y \\ d \text{ } r y \\ t \text{ } t \text{ } y \end{array} \right\}$	d to-	fib o-	m l	p lo-	$\left. \begin{array}{l} y t \text{ } l y s \\ t \text{ } p h y \\ h y p \text{ } t \text{ } p h y \\ p l \\ d \text{ } f f \text{ } t \text{ } t \\ f l \text{ } m \text{ } t \end{array} \right\}$
			d o-	gl o-	myo-	l l	
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			d th lo-	l o-	od o-	t t l	
p th lo-	lpo-	t	t do-				
rythr	lymph	p th lo-					

No ember 21 1917 the condition of the patient was much improved

November 2 1917 pulse 96 temperature 100 The patient was transferred to the Base Hospital

Report from Base Hospital General condition ery anemic and septic November 30 there was hemorrhage from the right femoral artery The artery and vein were ligated below profunda followed by transfusion of blood December 4 there was gain of the foot amputated lower third of leg

CASE 5 P T private age 2 No ember 5 1917 Suture of popliteal artery Through and through shell wound of left thigh A large oval opening (1.4 cm long) was found in the popliteal artery just below Hunter's canal The artery was sutured and the calibre of the lumen was reduced to one half of its normal size The tract of shell wound was excised a branch of the femoral vein was ligated and all the damaged muscles were excised A flap of fascia lata was removed and fastened over the line of suture in order to protect the latter from erosion by the Carrel Dakin tubes which were applied

November 6 1917 The highest temperature at any time was 99.4 pulse 76 The circulation of the limb was satisfactory The patient was transferred to the Base Hospital

December 2 1917 The patient wrote that he was getting along nicely had no pain and that the Carrel Dakin tubes had been discontinued

The treatment of lateral and perforating wounds of the larger vessels by suture in war surgery has resulted in only varying degrees of success That the results following its practice have not been more satisfactory may possibly be ascribed to a lack of proper regard and attention to some of the details in the technique In the Balkan War 1912-13 Wieters Pa ha and Vollbrecht sutured the wounded vessels whenever possible because they agreed with Kuttner that the danger of gangrene is thereby very considerably lessened and that a lumen decreased by suture is at least better than one quite closed by ligature Jeger considered it doubtful whether the requisite asepsis could be secured in the field hospitals In the reports of Delorme Dupuy de Frenelle and E Marquis the repair by suture is discouraged on account of the difficulties of technique L Sencert declares the results of suture as mediocre compared even with ligation which induces gangrene for instance in a very large percentage of wounds of the popliteal artery

Tuffier however in a discussion in the autumn (1917) meeting of the *Société de Chirurgie* recommended suture for the wounds of the popliteal and femoral arteries in war surgery

The failures in many of the cases reported may have been due to neglect of one or more of the essential points of the operation which are

- 1 A high degree of asepsis

- 2 The segment of vessel to be sutured must be freed from all macroscopic blood and properly protected from all contact during the suture

- 3 The sutures must not be introduced under too great tension

- 4 Thrombosis is favored by bacterial infection and by the tissue juices with their ferments The lumen of the vessel to be sutured should therefore be thoroughly washed with Ringer's or saline solution followed by liquid paraffin Sutures introduced under tension may cut out and induce hemorrhage

The technique of a vascular suture should therefore consist of the following steps

- 1 A free exposure of the injured vessel

A temporary occlusion of its lumen above and below the lesion either by flexible clamps, serrefines or tape

- 3 A thorough perfusion of the intervening segment with Ringer's solution or saline solution followed by liquid paraffin

- 4 A removal with scissors of the adventitia encroaching upon the line of suture

- 5 Silk sutures threaded on fine cambric needles and sterilized in liquid paraffin should be introduced through both media and intima carefully avoiding the adventitia

- 6 A deep vessel requiring repair may be rendered more accessible by lifting the vessel from its sheath upon two narrow ribbons This procedure may entail a division and ligation of one or more of the branches which hold the vessel in its normal anatomical position

- 7 A walling off of the remainder of the wound with pledgets of black silk will assist materially in safeguarding the line of suture from thrombosis and will also serve to make the delicate white sutures more easily seen by the operator

- 8 When a main artery is completely severed a circular suture should not be attempted unless the severed ends can be approximated without tension When this is not possible a segment of vein can be transplanted or when such a procedure is not practical a paraffined tube may bridge the gap and maintain the blood supply until an enlarged collateral circulation is established The tube should then be removed

Injury to the blood vessels of the extremities are more frequent than it appears from most of the reports of war casualties This belief was verified during a brief visit recently to one of the Casualty Clearing Stations where the above five cases with wounds of main vessels of the lower extremities were found among 63 wounded soldiers operated upon by the writer In all the 5 cases the wounds of the vessel were sutured and during the observation of the case showed in each instance satisfactory evidence that the lumen of the vessel remained patent





November 1 1917 the co-  
much improved

November 22 1917 pulse 0  
patient was transferred to the F.

Report from Base Hospital  
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from the right femoral artery  
located below profunda followe-  
December 4 there was gangrene  
lower third of leg

CASE P. T. private am-  
Suture of popliteal artery. The  
wound of left thigh. A large cyst  
was found in the popliteal artery  
canal. The artery was sutured.  
lumen was reduced to one half.  
tract of heel wound was excised.  
vein was ligated and all the  
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November 26 1917. The  
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December 12 1917. The patient  
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Photographs of a patient with injuries above the wrist and a large gap in the implantation of the dorsal nerve to bridge a two-inch gap of the absence of atrophy of the hypodermis of the patient to spread the paralytic atrophy of the distal end of the nerve marked radiologically diminished subsequent

neuritis. To make the  
an injury to the external  
has resulted in a gap of  
the axons of the proximal  
and axons of the distal  
filled with masses of scar  
as a preliminary to the  
aphenous nerve exposed  
popliteal space almost to the  
found in intimate association  
aphenous nerve. It is about  
diameter of the injured nerve  
segments are necessary to form  
the proper size. The nerve is  
in its bed at one end and doubled  
forward as indicated in Figure 6  
length slightly greater than the gap.  
The two little clamps are placed  
as shown in Figure 6 and then the  
nervous tissue with a sharp razor  
each end will present a clean cut end

## A SAFEGUARD IN INGUINAL ROUTE OPERATIONS FOR FEMORAL HERNIA

By MARTIN W. WAFF, MD, FACS, NEW YORK.  
From the St. Isidore Hospital, Philadelphia

IN performing this operation originally conceived by A. V. Mochowitz the one obstacle to its uniform and successful execution has been the difficulty of reducing the incarcerated strangulated and gangrenous intestine. The difficulty referred to consists in readily and safely dividing the constriction at Poupart's (Gimbernat) ligament from within by means of any guarded knife or bistoury. The proximity of the intended incision makes such a procedure very precarious and hazardous.

Hence where I failed to relieve the constriction from within I was obliged to resort to a free division of all overlying structures. Thus by the stroke of the knife Poupart's ligament was severed. Quite naturally the intestine could be readily reduced if healthy and dealt with accordingly if non-viable. But the division of Poupart ligament is an unwarranted sacrifice which renders its reconstruction eventually by suture impossible and also militates against the safety and certainty in the obliteration of the orifice of the crural canal by suture of Cooper's to Poupart ligament. Such division of Poupart ligament also vitiates the reconstruction of the inguinal canal as a step of this operation. In either case a relapse of the hernia would

follow necessitating the wearing of a truss even in anticipation of the recurrence and subsequently in doing an operation fraught with considerable difficulty and uncertainty as to the outcome.

To circumvent this disaster I propose the division of the constriction from within by means of a fine silk thread. This thread can be passed by means of a Deschamps needle or any needle sufficiently blunted or by means of the eyelet of a fine silver probe. By gently whip-sawing the thread a very exact and partial division of the fibers of Poupart may be executed which can never injure the intestine and sometimes the slightest excursion of the thread will be sufficient to re-establish the circulation of the intestinal contents and render the reduction of the gut possible. The thread may even be used as a tractor during the reduction. Thereafter it is divided and withdrawn.

In three cases of strangulated femoral hernia with incarcerated gut content operated upon by the inguinal route this technical addition has proved efficient because it is performed very quickly with great ease and is fool-proof against injury to the most impured gut and above all makes for the certainty of carrying out the operation in all its niceties and successfully.

## AUTOPLASTIC NERVE TRANSPLANTATION IN THE REPAIR OF GUNSHOT INJURIES

By LEO MAYER, AM, MD, NEW YORK.

THE suture of gunshot injuries of nerves which have been completely divided is in numerous cases rendered impossible either by the extensive loss of substance suffered at the time of the injury or by the marked degeneration of the nerve stump developing subsequently. In some cases the hiatus between the nerve ends can be overcome by flexing the limb. This applies particularly to injuries of the median and sciatic nerves. In the case of the ulnar something can be gained by transposing the nerve to a position anterior to the elbow. These

methods however require extensive dissection of the nerve and immobilization of the limb in a position which though at first physiological gradually becomes pathological owing to the formation of scar tissue. There is always more or less difficulty in straightening out limbs which have been flexed for the purposes of nerve suture and it is by no means impossible that the gradual stretching to which the limbs have to be subjected has a deleterious effect upon the nerve regeneration. Certain it is that the percentage of recoveries in a series of seventy nerve sutures



Figures 1 and 2 Photograph of a patient with an extensive injury to the musculospiral nerve six months after implantation of the external saphenous nerve to bridge a four inch gap of the musculospiral

performed by me was distinctly less in all those cases in which this procedure had to be resorted to

In a paper published in the *International Journal of Surgery* for March 1918 as well as in a book entitled *The Orthopedic Treatment of Gunshot Injuries*<sup>1</sup> I have outlined a method of bridging the gap between nerve ends which on *a priori* grounds is physiological and which in practice has given unusually good results (see Figures 1-4). The method consists in the implantation of a sensory nerve from the same individual between the ends of the injured trunk. As the sensory nerve is too small to equal the diameter of the injured several segments of the sensory must be used so as to build a nerve cable of approximately the same size as the divided nerve. The cable thus formed must have the axones of each segment brought into intimate contact with those which have been divided if regeneration is to occur.

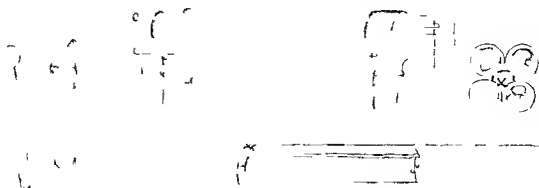
The technique outlined in these previous communications was by no means simple. I wish now to report a method which renders this method of nerve bridging easier. The essential is the utilization of a little clamp described by Dr. Bunnell. The Bunnell clamp designed for repair of tendons lend itself admirably by means of a slight modification to nerve suture. The clamps (see Figure 5) are made of thin flexible spring steel obtained at dental supply houses (S. S. White matrix steel gauge 003).

The original clamps had several longitudinal slits through which the needle could be passed. These are unnecessary for nerve work. The two arms of the clamp are held together by a little cuff. This in turn is fastened securely in position by means of a hemostat which at the same time serves as a convenient method of handling the clamp. The device is so simple that it can readily be made by any one who has a little mechanical ingenuity. Its great advantage lies in the fact that the nerve or tendon can be handled with a



Figures 3 and 4 Photographs of a patient with injury to the ulnar nerve 5 inches above the wrist one and a half years subsequent to the implantation of the dorsal sensory branch of the ulna to bridge a 6 inch gap of the injured nerve. Note the absence of atrophy of the hypothenar muscles the ability of the patient to spread his fingers apart and the comparatively slight atrophy of the interossei. The atrophy is distinctly more marked before the operation and gradually diminished subsequent to it.

minimal degree of traumatism. To make the technique clear imagine an injury to the external popliteal nerve which has resulted in a gap of 4 inches between the healthy axones of the proximal stump and the degenerated axones of the distal. The gap intervening is filled with a mass of scar tissue which is resected as a preliminary to the suture. The external saphenous nerve is exposed from its origin in the popliteal space almost to the heel. It is regularly found in intimate association with the external saphenous nerve. It is about one quarter the diameter of the injured nerve and therefore four segments are necessary to form a nerve cable of the proper size. The nerve is freed, lifted from its bed at one end and doubled backward and forward as indicated in Figure 6 making each length slightly greater than the gap to be bridged. The two little clamps are placed in position as shown in Figure 6 and then the nerve trimmed with scissors or a sharp razor so that each end will present a clean cut cross



action (see Figure 1). A single suture is now taken holding the suture element to the inner otherwise the suture would come apart when the clamp are removed. The nerve cable is now fastened in place between the end of the injured nerve by the silk perineural suture, one suture at each end (Figure 2). The course of the injured nerve is held in place and it is lifted out of the carpal tunnel. Whether it is admissible to suture the line of suture with a suture in Carpal tunnel is a hard case. It is a question as to its exact experimental value.

The advantage of the transplantation method are:

1. There is no excruciating tension on the line of suture.

2. Immobilization of the limb in a flexed position with subsequent stretching is not necessary.

3. The technique when practiced is by no means difficult.

4. The clinical results for as far as I have been able to judge by my experience are superior to any other method of nerve repair.

## A NEW METHOD FOR THE RELIEF OF LATERAL FUSION IN CLEFT-PALATE OPERATION

B. M. V. FEDER III, B.S., D.D.S., M.D., M.S., W. V.  
F. I. D. I. L. S. D. I. S. I.

IN order to have the reader fully appreciate my method for the relief of lateral tension in cleft palate operation it will be convenient to describe the technique of combined uranoplasty and staphylorrhaphy.

While much has been said and done in the surgical correction of the effects the method universally employed is that known as Langen-

beck. The Langenbeck operation is accomplished by dissection of mucoperiosteal flaps obtained from either side of the cleft and sutured in the middle line. Although called after the great German surgeon and rightly so inasmuch as he first clearly enunciated the principles underlying the operation it is certain that similar plan had been previously employed by others.

Operations upon the soft palate were undertaken much earlier than upon the hard. As far back as 1760 a dentist named Lemonnier united the borders of a cleft in a child. Deault and others record similar cases in the first decade of this century.

M. Krimer seems to be the first who attempted operative treatment on the hard palate (184). Dieffenbach, Warren, M. Bean, Ellis, Avery, Graef, M. Ronx and a number of others attempted surgical correction of palatal defects in the early part of the eighteenth century, followed by Dieffenbach, Mason, Polloch and a number of surgeons abroad and in this country.

The Langenbeck operation consists of the following steps:

1. Freeing of mucoperiosteal flaps
2. Freshening the edges of the cleft
3. Placing and tying of sutures
4. Relief of lateral tension

*Freeing of the mucoperiosteal flaps.* This procedure is accomplished by cutting the mucous membrane along the entire borders of the cleft and separating the soft tissue by periosteal elevators and cutting the tissue loose from the distal surface of the horizontal plates of the palate bone. This should be done with great care in order to prevent tearing or lacerating which may seriously impair nutrition. Naturally this brings on considerable hemorrhage which can be stopped by firmly pressing a sponge gauze against the bleeding surface. It is not always possible to avoid wounding the anterior palatine and especially the posterior palatine artery. Should one of the vessels be nicked it will cause

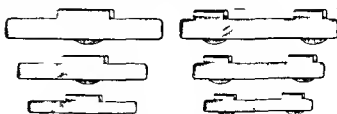


Fig. 2 (at left) Type A Author's tension plates  
Fig. 3 Type B Author's tension plates

severe and prolonged hemorrhage. It is therefore better completely to divide the vessel so that it will contract at its ends thereby overcoming protracted bleeding.

*Freshening the edges of the cleft.* This can best be accomplished by grasping the uvula on one side with a catch forceps and putting tension on the soft tissues, then with a very sharp thin-bladed knife cut a thin marginal strip along the entire flap from the uvula to the apex of the cleft. This same procedure is to be carried out on the opposite side. The freshened surface should be cut square with the flap tissue. A beveled surface is conducive to inviting failure. If the raw surfaces are cut square it is an easy matter to bring them together in close apposition which will enable rapid union during the healing period. In cases in which there seems to be a shortage of tissue in the soft palate I prefer to split the border of the velum about one eighth of an inch and then unite the raw surfaces.

*Placing and tying of sutures.* Various kind of suture material has been adopted for holding the pared edges together, such as silk, horsehair



Fig. 1

Fig. 1 Shows the suture cutting through the soft tissue.



Fig. 4

Fig. 4 Shows a cleft in the hard and soft palate.



Fig. 5

Fig. 5 Author's tension plate in position. The border of the cleft can be brought in contact by the plate. The plate can be held in place by the tension of the suture.



Fig 6



Fig 7



Fig 8

Fig 6  
In the illustration the patient is shown with the mouth open, and the surgical instrument is being used to make an incision in the palate.

Fig 7  
In the illustration the patient is shown with the mouth open, and the surgical instrument is being used to make an incision in the palate.

Fig 8  
In the illustration the patient is shown with the mouth open, and the surgical instrument is being used to make an incision in the palate.

lumen cut out wire etc. Practically I do not believe that the difference in value of the above named suture material is of any great consequence provided the operator does not depend upon the amount of suture material tension. Sir William Ferguson in 1844 recognized that the tension on the ligature frequently invited failure either through their cutting out or by shutting off the circulation thereby bringing on starvation necrosis and infection. To overcome this tension Ferguson divided the levator palati the palatoglossi and the pharyngeal muscle. In 1860 Agnew believed that the tension on the palatal muscles were responsible for pulling the newly approximated parts in the soft palate apart thus cutting the suture to pull out. Therefore he advocated making an incision close to the hamular process of the pharyngeal bone and in this way overcoming tension. For a long time the method was extensively adopted by operators in this and foreign countries. The results were not satisfactory. This was pointed out in a paper by T. W. Brophy in 1901 in which he says: "The formation of cicatricial fold from incision renders the soft palate thick and unyielding so that it functions poorly performed imperfectly." Brophy found it unnecessary to cut the muscles on either side. It was his intention to introduce the application of lead plates. The advantage claimed for the plate are that they render the palate inflexible and prevent the cutting out of the suture. Blair reports that he has discontinued the use of lead plate as a retention device because they occasionally cause loughing in spite of every care he depends entirely upon the sufficient freeing of the flaps. In my experience I have never found that the

plates cause loughing but that they did not prevent the cutting out of the suture (Fig 1). They are however of a distinct advantage in rendering the palate inflexible. In order to prevent the cutting of the suture through the soft tissue I have devised a new tension plate which will prevent the suture material from cutting out and at the same time relieve the tension as well as render the palatal tissue inflexible. The plates are made of noncorrosive metal B. I. B. American gauge in various sizes and type (Fig 1 and 2).

The object of these plates is to prevent the cutting out of the wire ligature which frequently happens with the Brophy plate. In order to fit these plates it is necessary to make a small incision near the gingival border of the last molar teeth careful not to cut the palatine artery. (The operator must take into consideration the degree of the cleft the position of the blood vessel and the type of plate that best suits his purpose.) The incision should be of sufficient length to permit the flange of the plate to enter and lie between the palatal bone and soft tissue. I refer to cutting the plate it is necessary to pass a wire (American gauge 24) through the mucoperiosteal flap and then through the hole in the plate. The end of the wire is then passed through perforated lead shot and made tense by pulling the wire and crushing the shot after which the border of the flap can be approximated without tension. After this is done I denude the border of the flaps and then place and tie the approximating suture after the McCurdy method.

While to the beginner it is rather a difficult procedure properly to fit the plate he can with



Fig 9

Fig 9 Button hole opening in the center of the palate



Fig 10

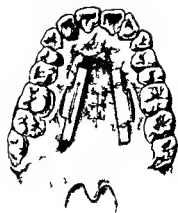


Fig 11

Figs 10 and 11 Showing advantage of using type A tension plates for closing the opening shown in Fig 9

a little patience soon master the technique of this simple procedure as an aid in obtaining uniform anatomical as well as physiological results.

Figure 4 illustrates the cleft of the hard and soft palate. Figure 5 shows the same case with the plates in position. Figure 6 shows the same case and the operation completed. These plates are now relieving the center ligatures so that healing can take place without tension.

Figure 7 shows an extensive cleft of the hard and soft palate. This patient for years had

been wearing an obturator. Fig 8 shows the same case with the palatal opening closed and held so with type B tension plates. Healing took place rapidly in this case and the patient was discharged ten days after the operation.

Figure 9 illustrates the so called "button hole" opening in the center of the palate. This form of opening usually is the end result of an attempt to close the hard and soft palate. Figures 10 and 11 show the advantage of using the author's type A tension plates for closing such opening.

## PLACENTAL TISSUE AS A GALACTOGOGUE

By EDWARD L. CORNELI, M.D., CHICAGO  
F. M. C. (Ch. G. Lym. I. Hosp.) I. D. D. Pe. ry

FOR many years the medical profession has sought an efficient galactagogue but until now it has not succeeded in securing anything which has proven of undoubted value although various methods have been employed such as different drugs, autotherapy, glandular therapy, massage, electricity, and dietary measures.

Glandular therapy has recently been brought to our attention and remarkable results have been obtained with it in the hands of some physicians. Others trying the same methods have not been so successful. Pituitrin has been given hypodermically and while it is continued an increased flow of milk is secured. The extract of

the thyroid gland has been recommended with like results. It is questionable with our present knowledge of the effect of these drugs whether it is advisable to continue their use over an extended period.

At the suggestion of one of the manufacturing companies<sup>1</sup> I became interested in the use of placental tissue as a galactagogue. The preparation I used is made from the placenta of cows. The placenta is washed and dried after which it is put up in 5 grain capsules. In the early cases the results were not very satisfactory as the dosage had not been determined. After experimenting I finally decided that 5 grains given

P. L. D. & C.





FIG. 1  
1 6 Sh 1 ft 1 1 th 1 At 1 1 1  
1 A d 1 ft 1 1 d 1 ft 1 1

FIG. 2  
1 6 Sh 1 ft 1 1 th 1 At 1 1 1  
1 A d 1 ft 1 1 d 1 ft 1 1

FIG. 3  
1 6 Sh 1 ft 1 1 th 1 At 1 1 1  
1 A d 1 ft 1 1 d 1 ft 1 1

linen catgut suture. For many years it has been the custom to use the difference in value of the suture material of any great consequence provided the suture does not depend upon the time of suture. In 1844, Sir William Fergusson, in 1844, recommended that the tension on the suture frequently invited failure either through the cutting out or by cutting off the circulation thereby inducing necrosis and infection. To overcome this tension Fergusson devised the lateral palatal plate and the palatal pharyngeal muscle. In 1860, Alexander, who believed that the tension on the palatal muscle was responsible for pulling the newly approximated surface on the palatal suture, thus causing the suture to pull out. Therefore he advocated making an incision of the hamular process of the plate and the suture was overcome tension. For a long time this method was extensively adopted by the surgeons in this and foreign countries. The suture was not satisfactory. This was pointed out in a paper by T. W. Brophy in 1901 in which he says: "The formation of a suture following incision renders the palatal thick and unyielding, that it functions as a permanent imperfectly. Brophy held it unnecessary to cut the muscle on either side. It was when introduced the application of a gold plate. The advantages claimed for this plate are that they render the palate inflexible and prevent the cutting out of the suture. Blair reports that he has discontinued the use of a gold plate as a retention device because they occasionally cause sloughing in spite of the fact they are dependent entirely upon the sufficient friction of the flap. In my experience, I have never found that the

plate causes a union, but that they did not prevent the cutting out of the suture (Fig. 1). They are however of a distinct advantage in rendering the palate inflexible. In order to prevent the cutting of the suture through the soft tissue, I have devised a new tension plate which will prevent the suture material from cutting out and at the same time relieve the tension as well as render the palatal tissue inflexible. The plate is made from non-corrosive metal. It is a B. I. B. American gauge in various sizes and types (Fig. 2 and 3).

The object of the plate is to prevent the cutting out of the suture which frequently happens with the Brophy plate. In order to fit the plate it is necessary to make a small incision near the gingival border of the lateral maxillary vein, careful not to cut the palatine artery. The operator must take into consideration the degree of the cleft, the position of the blood vessel and the type of plate that be used (purpose). The incision shall be of sufficient length to permit the flange of the plate to enter and lie between the palatal bone and soft tissue. In view of fitting the plate it is necessary to provide a wire (American gauge #4) through the mucoperiosteal flap and then through the hole in the plate. The end of the wire is then passed through perforated holes in the hot and cold tissue by pulling the wire and crumpling the hot tissue which the border of the flap can be approximated without tension. After this is done, I denude the border of the cleft and then place and tie the compound suture after the McCurly method.

While to the beginner it is rather a difficult procedure, properly to fit these plates, he can with

TABLE I—Continued

C N	P	N t lty	Age	S B b	B rth W h t	D y beg t g	W ght th d y	R m k
43		Am	33	F	7 534	6	6-4	
44		N t R	3	F	7 534	6	7 5 5	
45		Am	3	F	8 5	5	7 0 5	
46	3	Am	4	M	7 5 5	4	8-7	B t p mped
47	7	J h	43	F	7 75	4	8-6	Cx t p mped
48		J w	9	M	6-3 5	4	8 5	
49		Am	7	M	5-9 5	4	5 8	
50		Am	4	F	6-3 16	4	6-7	
51		Am	3	F	8 5	4	8 3 5	
52		Am	4	F	6 3 16	5	6-4 5	
53		J w	3	F	8 5	5	8 3 5	
54		Am	3	M	0-4 75	5	8 5	B t p mped
55		J w	4	F	8 5	5	8-4 6	
56	4	Am	34	M	7-6 75	5	7 5 5	
57	3	J w	3	F	0 5	5	6 3 5	
58		J w	3	F	7 5 5	5	7 3 5	
59		Am	7	M	6 3 5	5	6-4 5	
60		S d	7	F	7 4	5	8 5	B t p mped
61		Am	7	M	6-4 5	7	6-8	
62		J w	9	F	8 5	5	0-3 5	
63	3	J w	9	M	8 75	5	6 5 5	
64		Am	5	F	8 3 6	7	7 5 5	
65		J w	5	F	7 5	5	7 7 5	
66		J w	6	M	0 5	5	7 0 5	
67		J w	3	M	8 3	5	7 8 75	
68		Am	3	M	8 3	5	7 4	
69		J w	5	F	6 3	5	6 4 5	
70		J w	7	F	6 3	5	6 3 5	
71		J w	6	M	6	5	6 75	
72		Am	7	F	8 4	5	8 5	(W ght 9th d y)
73	4	J w	3	F	7 0 75	4	7-6 75	(W ght 8th d y)
74		Am	36	F	5 5	4	5	
75	3	J w	3	F	7 75	5	7 6 5	
76	3	Am	3	F	7 5	5	6-5 5	
77		J w	8	M	7 5	4	8 5 75	
78	4	J w	3	M	6 7 75	5	6 5	
79		J w	4	F	6 5	5	5 4	
80		J w	4	F	6 0	5	7 6	
81		L h	4	F	7 8 5	4	7 4	Casa t
82	6	J w	9	M	7 8	4	7 75	
83	4	J w	35	F	6-4 5	5	6-3 75	(W ght 9th d y)
84		J w	3	F	7 5	4	7 5	
85		S d	3	F	7 7 5	5	7 6 5	
86	3	Am	9	M	5 3 75	8	5 3 75	S pp f d g
87		J w	5	F	5 3 75	5	5 3 75	
88		J w	5	M	7-6 5	5	6-0 5	
89		A t l	5	M	4 5 5	5	4 5 5	S pp f d g
90		J w	9	F	7 5	5	6 3 6	O p o t M d f p
91	3	J w	5	F	6 5 5	4	7 5	(W ht 8th d y)
92		Am	3	M	7	4	2 5	
93		J w	9	M	0-5	5	8 3 5	(W ght 9th d y)
94		J w	6	M	7 75	4	7 5	(W ht 9th d y)
95		J w	3	F	7 4 6	5	7 4 75	(W ht 9th d y)
96		J w	6	F	7 5 5	5	7 5	
97		J w	6	F	6 5 75	4	7 5	B t p mped
98		J w	3	M	7-6 5	4	6-5	
99		S d	37	F	8 6 5	5	8 5	
100		J w	3	M	6 8	5	6 5	
101		J w	3	M	7 4 5	5	6-3 75	
102	3	J w	3	M	8 3	4	8 4	
103		J w	6	M	6-5	5	6-0 5	
104		Am	6	F	6 5	4	6-5	\ ed g babes 4th d y
105		Jew	6	F	7 3	4	7	
106		Am	6	F	7 5	4	7 5	
107		Am	4	M	7-6 5	5	6-5	
108		Am	30	M	9-4 5	5	8 4 5	S pp f d g
109		J w	33	F	8 5	4	8 3	M d m l g i
110	4	Am	3	F	6-7 5	5	6 75	
111		S d	3	F	7 4 5	5	7 5 6	
112		J w	9	F	7 4	6	7 3 5	
113		J w	9	F	7 75	5	7 75	
114		P i h	9	M	7-6 75	5	7-8 5	
115		Am	6	F	7 5	4	7 5	
116		J w	4	F	4 5 5	9	4 5	
117		J w	4	F	7-0	7	7	

C x wh h d d t c n p l t i t t

TABLE I

C N	P	N	A	I b	Birth W h	D y be m	W h d y	R m k
		I		I	6 8	6	7 7	
		I	3	M	0-8	5	6-	
		I		M	0-0		6- 5	
		d		F	0-0		6- 5	F r m h
		Am		M	8		8 7	
		I		M	8		6-0	
		h	8	F	8		4	
		I		M	8		8	
		Am		F	8		5	
		I		M	5		8 8	F p
		Am		M	4-		5	
		Am		M	8		8	
		I		F	0-0		6-	
		Am		M	6-0		8-6 5	
		I		M			7 6 5	
		Am	3	M	8		8	M d f p
		I		M			5	
		Am		M			7 8	
		I		M			5 5	
		Am		F			5	
8		I		F	0		6-	
8		Am		M	8		5	
		I		F	0-0	5	5	
		Am		M	0		5	
		I		M	0-0		5	P mped m l k d l
		Am		F	0-0		6- 5	C sa be
		I		M	0-0		6-	
		Am		M	0-0		7	
6		I		F	8 0	5	6	
		Am		M	6		5	
		I		F			5	P mped m l k d l
		h		M	4		5	pp feed
9		Am		M			8	Mod f m l k
		I	5	F	0-0		6-	m l k d l
		Am		M	0-0	5	6-	
		I		M	0		5	4 5 m l k d l
		Am		M	0		6	I p
		I		F	0		6-	
		Am		M	0		8	
3		I		F	0		6-	N mped
6		I	8	M	0		5	
		h		F	0		7 3	N m d
		I		M	0		7	N be l f d
		Am		F	8		8-0	
		I		M	4		8	B e l
		d		F	8 8		5	I p mped
		Am		M		5	7 5	
		I		F		5	6-	

h b d d ec pl f

TABLE I—Continued

C se N	P	N t ity	Ag	B be f	B th W ght	D y be t g	W ght th d y	R m k
43		Am	33	F	7 53 1/2	6	6-4	
44		N	3	F	8 7 1/2	5	7 8 5	
44		A t	3	F	8 5	6	7-9 5	
45		Am	4	M	8 5 75	5	8 5 5	B ast p mped
45	3	J w	7	M	7 5	4	8-6	Lava et
46		J h	43	F	7 75	4	8 5	
47	7	J w	7	F	6-5 5	6	6-	
7		J w	9	M	6-9 5	4	5-8	
8		Am	4	M	6-5 1	5	6-7	
9		S ed	3	M	6-5 3 1/2	4	8 3 5	
49		Am	4	F	6-5	6	8 3 5	
5		Jew	3	F	8 5	5	7	B t p mped
5		Am	6	M	6-4 75	5	8-5	
5		Am	4	F	8 5	5	8-4	
5	4	A t	34	M	6-6 75	5	6-3 5	
5		J w	3	M	7 5 5	5	7 3 5	
5	3	J	3	F	6 3 5	5	6-4 5	
53		Am d		M	7 4	5	8 5	B ast p mped
54		Sw d		M	6-4 5	5	5-8	
54		Am m	4	M	6-4 5	5	6-3 5	
55		J w	7	F	8 75	5	8 5	
56		J w	9	M	7 5	5	6-5 5	
57	3	J w	5	F	8 3 1/2	6	7 7 5	
57		J m	6	M	9 5	6	7 8 75	
58		J w	3	M	8 3	6	7 4	
59		Am	5	F	6 3	5	6-6	
60		J w	7	F	6-4	5	6-4 5	
60		J w	6	M	6 5	4	6-3 5	
6		J w	6	F	6	5	6-7 5	
6		Am	7	M	8 4	5	8 5	(W ht gth d y)
6	4	J	3	F	7-9 75	4	6-7 5	(W ht 8th d y)
6		Am	6	F	5 5	4	7-6 5	
63	3	J	5	F	7 75	5	6-5 5	
63		Am	3	F	7 5	5	7-6 5	
64		J w	8	F	7 5	3	7	
64	4	Am	8	M	6-7 75	4	8 5 75	
65		J w	5	M	6-7 75	5	6-	
65		J w	4	F	6-	5	5-4	
66		L th	6	F	6-9	4	7-6	
67	6	J w	35	F	7 8 5	5	7	Cava et
67		J w	35	M	7 8	4	7-6 75	
68	4	J w	35	F	6-4 5	5	7-6 75	(W ht gth d y)
68		J w	3	F	7	5	7 5	
69		d	3	F	7 7 5	5	7-6	
69	3	Am	3	M	5 3 75	8	5 3 75	S pp f d g
7		Am	9	M	5 7 5	8	5 1	
7		J w	5	F	7-6 5	4	6-0 5	
7		A t	5	M	7 5	4	6 5 1/2	S pp f ed
73		J w	9	F	7	5	7 3 1/2	Occ pot M l f p
74	3	J w	3	F	6 5	4	6-7 5	(W ht 8th d y)
75		Am	4	M	7	4	8 3 5	(W ht gth d y)
76		J w	9	M	7 75	5	7 5	(W ght th d y)
77		J w	6	F	7 4 7 1/2	5	7 4 75	(W ht gth d y)
78		J w	6	F	7 5 5	5	7	
80		J w	3	M	6-5 75	5	6-5 5	B t p mped
8		Sw d	37	M	6-8 5	5	6-2	
83		J w	8	M	7 5	5	6-3 75	
84	3	J w	3	M	8 3	5	8 4	
85		Am	6	M	6-5	5	6-0	
86	5	J w	6	F	7 3	4	7	N rsed g laves et h d y
87		Am	4	F	7-6 5	7	7	
88		Am	30	M	7 7 5	8	6-5	
90		Am	33	M	6-4 5	5	8 4 5	S pp f ed g
9	4	J	33	F	8 5	5	6 75	Mod milk g
93		Sw d		I	6-7 5	5	7 4	
94		J w		M	7 4 1/2	5	7 4 5	
96		P l sh		M	7-6 75	5	7 8 5	
97		Am	6	N	7 3 5	4	7 3	
98		J w	4	F	7 5 1/2	4	4 5	
99		J w		F	7-9	4	7	

C es h h d d t e s p l a t i t t



majority of these cases the stone was lodged about the pelvic brim or just below and was usually expelled after the second or third trial. In no case were there more than four efforts necessary to expel the stone.

A few points valuable in getting quicker results I think should be emphasized: hot sitz baths and hot applications over the affected side. Morphine should be used freely. Novocaine or papaverin sulphate solution should be injected in the ureter preceding olive oil injections. I think urethral irritation from the cystoscope aids materially by setting up reflex peristaltic waves. One case not included in this report who had suffered from stone in the ureter for a year was demonstrated very clearly by X-ray. After meatotomy of urethra he passed the stone the following day.

CASE 1 C. H. C. age 21 white occupation farmer. The patient's mother passed some small stone at intervals in the last few years and had suffered from kidney trouble for a number of years. The patient gave a history of good health until two years ago. At this time he noticed pains in left side which were referred to the left thigh, the left testicle and left side of the penis. He passed blood in that period of time. After a severe attack the urine was milky looking (phosphates). He had intestinal disturbances and different forms of treatment gave no relief. Venereal diseases denied.

March 16, 1918. Examined. Some tenderness as present over the left ureteral region. No reflex pains to left thigh, left testicle and left side of penis. There was general gastric disturbance with much gas in the intestinal tract. The urine was very heavy with phosphates and showed a few pus cells and streptococci but was otherwise negative. Cystoscopic examination showed the bladder normal, the right ureteral orifice normal, the left orifice small and slightly red. The catheter could not go higher than about four and one half inches. The X-ray showed a small stone in ureter, 1 pelvic brim.

March 1. Ureter below the stone was dilated with catheter and forceps. March 10. On inspection of orifice the stone was being through the meatus of ureter which was opened. Without pain the stone passed that night.

CASE 2 J. A. W. age 55 occupation minister white. Three years ago the patient began to have colic like pains in his left side which required doses of morphine for relief. He lost weight, suffered from general nervousness from that time and lived in fear of other attacks. Especially as he subject to great pain if he exerted himself.

EXAMINATION. There a slight tenderness over the left ureteral region. The urine showed a few pus cells but was otherwise negative. The X-ray showed a stone about the level of a pea at the pelvic brim. December 15, 1917. Cystoscopic examination. The trigone of the bladder was somewhat inflamed, the right ureteral orifice normal while the left looked somewhat red and slightly bulbous. The catheter met obstruction at the stone. The lower part of the ureter was dilated and injected with papaverin and olive oil. He had great relief for three days then the same procedure was repeated and he felt so much relief that he went home rejoicing but came back in ten days suffering greatly. The ureteral meatus was cut and the ureter dilated again. He passed the stone a few days later. Since then in no other symptoms have cleared up.

CASE 3 Mrs. J. age 30 white about three years ago began to suffer with urinary disturbance frequent urination and pruritus in her left side. She passed a small stone and was relieved for a while but the symptoms returned and she was forced to seek relief.

EXAMINATION. She was very tender over the left kidney and ureteral region. The urine showed a few pus cells and mucus. The X-ray showed a stone about two inches below the kidney pelvis. Cystoscopic examination showed the bladder to be normal, the right ureteral orifice normal, left slightly red and dilated. A catheter inserted in the left ureter met an obstruction in the hip. Injection of papaverin sulphate and olive oil after increasing the severity of pains for about two hours enabled her to pass the stone affording immediate relief. All her reflex pains were directed to the left inguinal area.

CASE 4 C. I. Grek age 43 occupation restaurant cook had always been healthy until six months ago when he began to have colicky attacks. The first attack lasted two weeks keeping him in bed. After that the attacks could come on at intervals of about every two weeks being quite severe in character with pain in left kidney region referred to the left leg and left side of penis radiating down the left leg and thigh. He also had gas in the intestines with general gastric and intestinal disturbances. Urine contained small amount of pus and few red cells. Tenderness over left ureteral and kidney regions. X-ray showed large stone above pelvic brim.

September 25, 1917. Cystoscopic examination showed a normal bladder and right ureteral orifice. The left orifice was pouched small and very red. The catheter stopped four and one half inches up. The lower part of the ureter was promptly dilated. The patient had severe pains that night saying he felt like something ripped and cut for two inches. He was free of pain for five days.

October 1, 1917. The catheter could not go up the ureter farther than one inch. The meatus was opened and the ureter dilated below the stone. That night he had a short severe attack followed by complete relief.

October 2, 1917. Cystoscopic examination showed stone in bladder left orifice red and swollen. Stone passed in three hours and gastric and ureteral symptoms disappeared.

## CONCLUSIONS

Ureteral stones in almost every case produce very annoying gastric symptoms. Several of my cases were treated for such symptom but were not relieved until the stones were removed.

We should consider carefully the nervous supply of the ureter namely inferior mesenteric plexus and pelvic plexus for here is the answer to the symptoms of intestinal unrest.

It is a conservative statement to assert that 90 per cent of ureteral stones may be removed by the method outlined thus avoiding a radical operation. A careful cystoscopist does no harm in the manipulation even if he fails. The patient loses very little time and adhesions that may follow a cutting operation are never produced. All ureteral stones should be removed for the health of the kidney. Stones that do not show by the X-ray may be diagnosed by the wax tipped catheter urinary findings obstruction and other suggestive symptoms.

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

PLUCLAR MEETING APRIL 5 1918 DR CARL BECK PRESIDENT IN THE CHAIR

DR RAY L M DIF POKE P thol gical  
E d f D ea An ng Man an Extinct  
An al (See p g 408)

### SUBDIAPHRAGMATIC ABSCESS

D E i nul F l real p pe entitled  
S l l pl g u At c (See page 408)

### DISCUSSION

DR IAN RANCE RYAN The number of c e th t  
l h i h d i p p tu ty to tabul te s n t so  
l ge tlat p e t i b v Dr F n l b u m m e  
e p e t h t i i n t e t g n l d f f r f t l  
from h The f r t c p e r a t d u p n a t the  
C k C u n t y H s p t l f i l l o n n t t a c k l  
m u l t i l y s t v T o v e b e f e r t h  
w h e l v i g n t e r k o n t r a t e l a l a  
a d i a g n w m a d f a m b e d y t e r v a n d h e  
w t e t e l t h e f a b u t a y e r f t h t e n l t o n  
H e c a m e n r t h t h v m p t o n s h r d p t c a l l y  
a l l b l e d b u t v r v o n t h e r a f t e r c o m p l a i n e d  
f r o m t m t t m e f p n n h i r i g h t s i d e a n l o f  
g d l d a b i l i t y H e u l l h a t t a c k s t h t  
h e u l d n t k a n l h e l e c m m e a d m  
d i a b l e d u t l e a p p l i t h m h i t a l f t r e a t  
m e n t A t t h t i m e h u g h t s i d e w a q t e p a i n f u l  
H e h d v l t t e m p a t u e H e e n t f r m  
t h e n n r m t h a d i g n f p l e r y  
t h e f f u i o n D u l l e s n t h e i g h t s l e a q t e  
m a r k e d

In l o k i n g o e t h e r e o r d f s e a t t h e C u t y  
H o s p t a l a d f t h e r s h c h l h a e h a d u p t o t h e  
p e e n t i m t h e e v e r 36 n l l b u t m o s t f t h e m  
e e s t h e C o k C u n t y H o s p t a l P r c t c a l l y  
a l l o f t h e p a t i e n t s c o m p l a i n e d o f s y m p t o m s s i n  
p l e u r i s y t h e f f u o o t h a n e m p y e m T h e  
g r e a t e n u m b e r f t h m e r e s e n t n t o b e o p e r a t e d  
u p o n f o r e m p y e m a I n s o m e f t h e m t h e p h y s i c a l  
f i n d i n g s e r e d i l l e n t h e r i g h t s i d e h u c h e  
t e n d e d a s h i h u p s t h e s e c o n d o t h i r d r b a n d t h e  
X r a y f i n d i n g s e t y p i c a l e x c p t i n a f e v h e r e  
t h e e a s s o m e f f u s n a b e t h e d a p h r a g m  
T h e r e v a s a l i t t l e c l u d i n e s f t h e p i c t u r e a b o v e  
b u t w t a h g h m m o b i l e d i a p h r a g m s u h a s y o u s e e  
h e e t h e r s n d i t m a k n a d i a g n o s i s o f  
a n y t h n e c e p t s u b p h e n i c b s c e t h t h e  
h i t o r y f t e m p t u e n d o f r t h o r s o m e g r o t h  
b e l o t h e d a p h r a g m

T h p t i n d r y l a c a r e a f d u l l n e s o n t h e  
r i g h t s i d e H e w o p e r a t e d u p n t h e b s c e s w s

d r a i n e d d l l e a p p a r n t l y d r a i n a g e a s s u f f  
c e t l y p e r m a n e n t t o a f f o r d r e l i e f f o r s e v e r a l m o n t h s  
c e n t u a l l y t h e n a n d i e d

T h n e t c a s e i e o f s u b p h e n i c a b s c e s s b u t  
o t h e r i g h t s l t h e c o n d i t i o n n o t s o c l e a r T h e  
p a t i e n t s p e r i t e d u p o n f o r a p u s a p p e d b y  
n e f t h e m e m b e r s f t h s S o c i e t y I t h e c o u r s e o f  
t h e e o r f u r m o n t h t h e p a t i e n t d e v e l o p e d s y m p t  
t m h c h p o i n t e d t o a s u b p h e n i c a b s c e s s A n  
i e s o n a s i r t m d a n t e r i o r l y a n d n o t h i n g v a s  
f u n d t h e a p o s t e r i o r p e n u g a m a d e a n d a  
m u l t a m o u n t o f p u a s f o u n d t o b e p r e s e n t v h c h  
a d n d T h p e r i t o n a s d o n e a b o u t a y e a r  
a n d h a l f a g o T h e e h a s b e e n v l i g h t d c l a g e f r o m  
a s i r u t e n t a l e v e r s i n c e T h e s y m p t o m  
g r a d u a l l y g e o r e a d t h i s s u s v a s i n j e c t e d  
i n l b m u t h p a t e l A g n o s i s w m a d e o f s u b  
p h e n i c a b s c e

T h e r e c o l o f t h e C o u n t y H o s p t a l s h o w t h a t 8  
p a t i e n t o u t o f t l e 36 d i e d

O n e o f t h e b e s t r e s u l t s h d a s i n a c a s e v h e r e  
w e r e e t e d t h e e i g h t h a n d n t h r i b s a d e t b l e d  
d u n a e I t h e l a s t c a s e o p e r a t e l u p o n w t  
n o v e r t h e e i g h t b r e c t e l t d o i n t o t h e c o t l  
m a r g n d o p e n e d i n t h e c e t y h c h h e l d  
a b t a q u a r t f p u s t h t h e b i m u t h p a s t e  
T h t y a s h o l l y s u b p h e n c a s f a r a s v e c o u l d  
d e t e m i n e F o r t h r e e m o n t h s t h m a n w a s e x p e c t  
t a n g p u u l e n t m a t e r i a l t l e v e r y e v i l e c e t h a t  
t c a m e f r a c c o l l e c t i n f p u s i n h l g t h e  
b l e f a s t h a t t h e r e a s o m e c o m m n c t i o n b e  
t e e n t h e s u b p h e n c a b s c e s s a n d t h e l u g i t s e l f  
N o d i r e c t c o m m u n c t i o n b e t w e e n t h t o c o u l d b e  
f o u n d b u t t h e r e s a n i n d i c a t i o n t h a t h e h a d  
a n o t h e r c o l l e c t i o n f p u s a b v e I n e x t e n d i n g t h e  
i n c i s i o n u p v a r l I t o o k o u t i n c h e s f r i b t o h a v e  
t h e c a v i t y f l l n T h e p l e u r a v a s o p e d j s t  
a b o v e I p u t m y f n e r n b e l o w t h e p l e u r a w a s  
s u t u r e d t o t h e d i a p h r a g m o t h a t t h e r e v a s n o b a d  
e f f e c t f o m i t a n d n o i n f e c t i o n o f t h e p l e u r a f l l o y e d

I n t h e f r s t c a s e s h o w n v e r e c t e d t v o r i b f o u r  
n c l e o f e a c h c u t o u t t h e t c o s t a l t i s u e b e  
t e e n t h e t v o r b s a n d t h e c a v i t y a t n o t i m e r e  
t a i e d n y p u s I n a f e c a s e s a m o n g t h e r e c o r d v  
t h r g b a n d t l o u h o p e n i n g w a s m a d e

T h c s o f u b p l i c a b s c e s s w a s o p e d v t h  
t h e u d e t d t h t t a s c a s e o f p l e u r s y  
v t h e f f u s n o r e m p y e m a T h f i s t u l o u s t r a c t v a s  
i n j e c t e d t h b m u t h p a t e l a t e r H e e n o t h  
v i e w o f t h e s a m e c a s e s h o n g t h e t e b m t h

area with extension up above into the pleura. There were four or five of these cases that had permanent fistula. Some of these fistulae were discharging pus through the bronchi and one or two patients expectorated bile not infrequently. One patient we had at the County Hospital during the winter who did not stay for an operation was expectorating bile quite frequently.

Many of these cases have been examined bacteriologically and in various other ways. One thing that struck me in these cases of amebic dysentery is that they have a distinct amebic history very frequently that after the attack of diarrhea the first year or two and recover from it. In no case were amebic coli found in the feces or in tissue after the patient entered the hospital although nearly every case was examined for bacteria by the intestine in charge. One patient had 16 bacteriological examinations made with a view to locating the organism but without success.

The bad results in some of the case came from inadequate drainage at the start. There was one point in which these cases differed clinically from those of Dr. Friend, namely that a large percentage of them gave a history of gall bladder infection. I started out with the understanding that many of these cases were due to pus appendix or to a perforating gastric or duodenal ulcer but examination of case records convinced me that many of them follow chronic infection of the gall bladder.

There is one class that is more acute than Dr. Friend mentioned. In some cases of perforated gastric ulcer the patient may have an acute subphrenic abscess running along the upper surface of the diaphragm. He has chills and presents the clinical picture of a pneumonia. If you examine a patient after the rupture of such an abscess with the infection traveling to the upper surface of the diaphragm you will find very little pus but the physical findings are those of a pneumonia due to the extension of the virulent form of infection that caused the subphrenic abscess.

DR. DANIEL N. LISBERG. I have had 11 together about ten cases of subphrenic abscess and I want to endorse what Dr. Friend has said in regard to the value of X-ray examination. I believe today that there are two methods which have supplanted practically all our means of physical diagnosis and exploratory puncture in fully 75 or 80 per cent of the cases, namely the X-ray plate method and fluoroscopic examination. I want to recommend especially fluoroscopic examination. In my last few cases I have gone into the X-ray room and have been edited by watching the movements of the diaphragm which you cannot get in a cold plate. In a case of this kind if you watch the manner in which the diaphragm moves, i.e. instead of moving up and down symmetrically as it does on the two sides you will observe a difference in the manner in which it rises on the side where the subphrenic abscess is and you will gain more information than you will by the ordinary plate method.

It is not frequent for these abscesses to be as large as those Dr. Friend and Dr. Ryan have shown. Of the 10 cases I have seen in many of them the abscesses were small not containing more than three or four ounces of pus yet rendering the patient so septic that one died before we could recognize the abscess. That was in the earlier days before we used the X-ray in diagnosis and autopsy showed the abscess located not along the upper portion of the diaphragm but along the lateral portion.

There are certain anatomical points to be considered. In the first place I endorse what Dr. Ryan has said in regard to the etiology. Not all of them are due to appendicitis. Fully 75 per cent of those on the right side are due to appendicitis but in one of my cases it followed a subcutaneous perforation of the gall bladder and in another a perforation of a duodenal ulcer. Of the appendicitis cases in practically all of them I have seen the appendix was retrocaecal so much so that I have profited by it in that I make it a rule now if I operate upon a perforated or gangrenous appendix with retrocaecal abscess to insist on putting the patient in the Fowler position in order to prevent the formation of subphrenic abscess.

With regard to the treatment I wish to mention the method of Lisberg of New York who evacuates these abscesses by the subphrenic route. I have tried in several instances to go through the transpleural route and in one case there was such a severe emphysema that the patient died so that I have tried in all other cases and have been successful since then to follow Lisberg's suggestion depending on a knowledge of the anatomy of the pleura. The pleura is reflected at the seventh, ninth and eleventh ribs. If you take the axillary line and resect a portion of the tenth rib you can very easily push up the diaphragm and pleural reflection at that point enter the subphrenic space and drain the subphrenic abscess without entering the pleural cavity.

I thought it might be of interest to you to mention this. I have dissected it on 26 cadavers and find it is true. There is a little variation sometimes in the pleura in certain cadavers in that it will go down almost to the eleventh rib. In the majority of them it goes to the lower border of the tenth rib and if you reflect the tenth rib and push the diaphragm up you can enter the subphrenic space and drain the abscess safely in that way.

DR. ARTHUR DEAN BEVAN. First I would like to emphasize the importance of operating upon these cases of subphrenic abscess under local anesthesia. If the diagnosis has been established from the clinical signs and X-ray examination and confirmed as a rule by the operating needle the operation can be so thoroughly done under local anesthesia and with so much greater safety to the patient that a general anesthetic is not necessary.

I want to emphasize what Dr. Ryan has said with reference to the importance of making a wide opening to obtain not a mere puncture with drainage





among them calcification in lymph nodes phleboliths and one very interesting thing is that of foreign bodies in the intestinal tract. I will cite one or two cases in particular which we have had recently.

I was called in consultation with a prominent surgeon and internist to see a man who was very much distressed. He had applied for life insurance and they found pus in his urine. The X-ray picture showed distinctly a stone in the ureter. It was about the size of the end of my little finger. The case was seen by a good surgeon who advised immediate operation. I took a more conservative view and could not see any urgent need for operation.

One thing that attracted my attention in connection with this case as in the shadows shown by the assayist was that there was not the same density throughout and in the particular case I refer to I urged taking another picture in a few days passing the ureteral catheter and taking an X-ray in that way. A few days later at the suggestion of the roentgenologist the patient took a good sized physic of some kind to empty the bowels after which another picture was taken and the shadow had disappeared. Later another picture was taken and the shadow was not present. In other words there was a foreign body of some sort in the intestinal tract which had passed.

I want to emphasize the point that the indication for operation in these ureteral stone cases is relative. In the presence of any emergency like anuria there may be a positive demand for operation. We must use good judgment in determining whether in a particular case a stone may pass normally or not. In our work it is a routine with us where we have a stone of the size of a coffee berry or smaller unless there is a definite and urgent indication for its removal to leave it alone and watch the case because we find in many of these cases the stones will pass normally. Some of them are assisted by the introduction of oil into the ureter. Unless there is a very definite reason I do not like to operate for the removal of ureteral stones in the lower end of the ureter deep down in the pelvis. As far as stones in and near the kidney are concerned and stones of good size in the greater part of the ureter above the pelvis there is very little question that they should be operated upon and can be operated upon with a good deal of safety to the patient.

I would like to say a few words in regard to the technique. In the upper ureter we are using the ordinary oblique kidney cut but for the greater part of the ureter we use the same incision as for an appendix case except that we make the old type of extraperitoneal operation such as was made for

ligation of the iliac vessels in years gone by. Where we want to make an extensive and wide exposure of the ureter if a wide incision is necessary we carry the splitting of the internal oblique across the rectus and strip up the peritoneum isolate the ureter and find the stone.

I think a certain technique should be followed because of several experiences we have had. After the ureter is exposed and the stone found a smooth book should be placed on the ureter above the stone. In several cases we have had the stone slip back into the kidney. Very often the ureter above the stone is dilated and you have the same difficulty you have with a stone in the common duct. In feeling around for the stone it is like squeezing a lemon seed between your fingers it slips up and you have to make an extensive oblique kidney cut before you get the stone. We put a hook on the ureter above the stone and a second hook below the stone the ureter is incised the stone removed and the ureter dropped back without making any attempt to suture it. A small cigarette drain is introduced and carried down to the ureter and it is surprising how rapidly as a rule the edges unite with very little leakage. Some of these cases will not leak a drop after an incision half an inch long in the ureter. Some will leak for a short time. Almost none of them are associated with anything like persistent fistula provided the stones have been removed.

I must say that stones in the ureter low down in the pelvis have been a great bugbear to me. Anatomically they are very difficult to get at. Some of them I approach through the perineum. Several times when we have had a large stone impacted in the lower end of the ureter I have done a right or left old fashioned lateral lithotomy and instead of incising the prostate and exposing it I have followed the prostate up to the ureter then incised the ureter over the impacted stone removed the stone and simply drained in that position. I do not think it is at all a standard operation nor do I know that it has found its way into the literature but in impacted stones of fair size the lower end of the ureter it seems to me it is a safer procedure than any other.

If I say anything of value in this discussion I would like to re-emphasize the position of being extremely conservative in our ureteral stone work of demanding a very definite diagnosis before committing oneself to an operation in the first place and in the second place of analyzing all the facts the size of the stone the possibility of the passage of the stone—a judicial weighing of the evidence for and against an operation—before one undertakes to remove it surgically.



# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS ON OBSTETRICS AND GYNECOLOGY

By GEORGE GILLHOIN M.D. F.A.C.S. St. Louis

THE duties imposed upon obstetrics by the Great War are daily becoming more imperative. Wars are not paid for in war time, said Benjamin Franklin, the bill comes later. This truth applies not only to economic conditions but to eugenics as well. The decrease of the birth rate which was observed throughout the civilized world prior to the war is bound to become more marked every day the conflagration in Europe continues. If thus the quantity of the breed cannot be increased it is obviously incumbent upon obstetrics to safeguard the quality of the offspring. And as every movement for betterment depend in the last analysis upon education we must needs redouble our efforts of educating the masses in the proper care both prenatal and postnatal of children. The living spoken word and demonstrations would best serve our purpose but books will go where lecturers cannot penetrate. The appearance on the market therefore of numerous books and booklets on the care of mother and baby is to be warmly welcomed. Several of these book have found their way to the reviewer's shelf.

The praiseworthy tendency to disseminate knowledge is common to them all and there can be no doubt that they will do a great deal of good. It would be well for physicians to pay more attention to this class of literature so as to be able from personal acquaintance to recommend to their patients an intelligent and reliable guide through pregnancy and to instill into them a realization of their part in the upbringing of children. Physicians will then see for themselves that some of these books, desirable though they be on general principles, fall short of their mark. A book for instance which introduces terms such as ectopic gestation and toxæmia without ever explaining these expressions shows defects that mar the excellency of the balance of the text. A book which devotes two chapters to a detailed account of the technique and the pros and cons of twilight sleep and sunnyslumber respectively which supplies prescriptions for sore throat, nose bleed and what not is constructed along faulty lines. As a rule however the mothers

guides very sensibly refrain from giving advice which would lead the reader to think that she can do without a physician and such books should be commended.

Lugenic legislation, says Havelock Ellis in one of his admirable *Essays in War Time* is a secondary matter which cannot come at the beginning. It cannot come before our knowledge is firmly based and widely diffused; it cannot come until we are clear as to the ideals which we wish to see embodied in human character and human action; it cannot come until the sense of personal responsibility toward the race is so widely spread throughout the community that its absence is universally felt to be either a crime or a disease. This wider vision of the subject is well represented in two of the books before me. In *My Birth* Mr. Lamson has chosen a most interesting and novel way to convey her message. She lets her own as yet unborn child tell in words that every one can understand the story of its development from a primordial ovum to a fully matured fetus that is about to be born. No detail is missing. The growth of the graafian follicle, the meeting with the spermatozoon, the segmentation of the ovum, the origin of the various organs and structures are narrated in this delightful autobiography, and even tubal pregnancy and congenital malformations find their place in the tale. A small book of 140 pages and yet a complete textbook on embryology made accessible to a circle of lay readers and adorned with numerous illustrations from medical works of recognized authority. Every now and again the little autobiographer branches off, he calls attention to the practical application of the facts revealed and makes an appeal to young mothers not to allow commercialized fashion and fad to penetrate the peacefulness of infancy and early childhood and hinder the normal development of a tender body, mind and soul. Let us hope that there will be many young mothers who are sufficiently intelligent and earnest to read and assimilate this treatise.

The book which I enjoyed even more and which I read with unflagging pleasure from cover to cover is Sarah Comstock's *Mothercraft*. The aim of the book is to put into non-technical English some of the newest teachings expressed by some of the safest and sanest specialists of today in other words modestly to act as interpreter. The greatest profession in the world that of mother

T E C T M H C B M G J Mod  
I d N Ph d lph Th J h C W t C mp  
L T M H C By W M S dl M D d  
L A S dl M D Ch G A C M Cl G C mp  
M B T Acc C C J ny  
A m T Lam N w k Tl M m C mp y  
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M. a. c. h. 3. N. t. b. y. D. H. e. c. The. c. r. i. d. p. u. l. t. e. t. r. n. g. l. y. j. t. a. b. e. the. l. e. l. o. f. the. l. i. l. Th. i. l. d. i. l. a. t. d. h. g. a. d. m. e. t. e. o. f. a. b. o. u. t. c. m. Th. e. r. i. l. l. i. t. l. m. a. n. n. p. u. l. a. n. g. t. h. t. f. i. t. h. f. m. a. u. i. s. m. No. p. l. e. a. n. b. e. i. l. t. h. g. h. t. d. l. o. r. i. g. h. t. f. r. e. c. h. l. Th. r. i. g. h. t. h. a. n. l. a. l. t. l. l. e. t. h. a. n. t. h. l. e. f. t. b. u. t. t. h. r. i. l. l. i. n. g. f. t. h. a. r. m. f. e. r. n. r. h. a. d. M. r. c. h. o. o. N. t. e. l. y. D. S. p. r. i. n. t. Th. m. a. r. k. l. q. u. i. t. y. f. t. h. a. i. a. l. p. l. t. h. g. h. t. l. e. n. g. m. l. l.

J. e. b. u. y. o. S. N. t. e. l. y. D. r. R. e. i. d. l. i. t. t. h. a. s. c. o. m. e. f. m. h. r. h. m. e. i. W. a. s. h. i. n. g. t. n. f. l. o. n. t. r. i. n. t. D. H. l. i. d. F. r. i. s. l. e. c. S. t. i. t. a. t. h. e. p. f. e. c. t. l. y. e. l. l. a. d. h. a. l. m. l. n. t. n. s. P. u. r. e. d. j. e. c. t. b. t. h. b. j. m. p. l. a. c. o. u. g. h. Th. r. i. g. h. t. d. i. l. a. t. i. o. n. g. l. e. f. t. a. n. d. t. h. a. t. i. d. g. l. i. t. h. n. l. f. l. u. i. d. h. f. e. m. a. l. l. y. n. o. u. h. a. s. l. o. t. o. t. h. e. n. h. i. l. Th. l. a. t. t. e. c. o. t. h. i. l. n. e. u. r. m. a. l. a. i. g. o. n. Th. l. a. d. l. e. n. u. t. l. y. t. h. u. h. a. n. d. i. n. t. l. y. p. a. l. p. i. l. e. Th. r. e. i. m. a. r. k. l. d. i. l. a. t. i. o. n. f. t. h. r. i. g. h. t. c. m. m. o. n. r. u. l. f. o. m. t. h. e. l. a. d. i. t. h. b. i. f. u. c. a. t. i. o. n. (F. i. g. a. n. d. 3). B. e. l. t. h. l. i. l. e. c. a. n. t. r. a. e. t. h. i. n. n. o. m. i. n. a. t. e. a. r. t. e. r. y. f. r. a. h. e. r. l. i. t. a. c. e. t. i. s. c. e. r. t. a. i. n. l. y. n. o. t. d. i. l. a. t. e. d.

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I. M. B. F. r. u. y. o. S. T. l. l. h. i. f. f. i. t. m. i. l. t. f. p. t. l. l. y. l. l. b. d. i. t. h. m. t. i. t. d. i. t. f. t. h. g. h. t. b. l. t. h. b. d. t. m. t. d. t. l. t. d. i. t. d. O. d. d. b. D. S.

a. b. t. h. p. p. e. r. l. g. f. t. h. e. l. a. n. d. F. r. o. m. t. h. i. s. p. o. t. h. t. i. m. t. e. l. m. n. h. e. r. t. h. e. r. r. a. p. i. d. l. y. g. n. t. m. t. n. q. u. i. t. t. h. f. t. h. v. e. s. l. i. t. h. t. h. e. m. m. t. n. a. n. l. m. t. y. l. d. c. a. l. b. u. t. s. l. i. g. h. t. l. y. t. r. p. i. n. f. o. m. t. o. t. h. e. b. i. f. u. c. a. t. i. o. n. (F. i. g. 3). Th. i. n. n. o. m. i. n. a. t. e. h. i. c. h. a. t. h. o. p. e. r. a. t. i. o. n. c. n. i. d. i. l. a. t. e. d. i. t. y. t. h. e. m. e. t. a. l. t. u. l. i. o. m. l. l. r. l. l. t. h. a. n. a. l. o. v. e. i. t. — s. m. a. l. l. e. r. p. r. b. l. y. t. h. a. n. n. m. l. A. l. t. t. h. i. r. i. t. i. f. i. l. a. l. o. n. g. t. h. e. h. o. l. e. c. u. f. t. h. r. i. g. h. t. c. r. i. d. l. u. d. e. s. t. j. t. b. e. t. h. b. l. i. t. t. h. r. i. b. i. t. t. r. t. h. e. m. i. n. t. P. r. u. h. c. t. h. e. m. t. o. b. l. i. t. t. e. p. u. l. n. t. h. e. c. t. d. Th. i. l. l. s. r. e. l. y. o. u. r. n. g. t. h. g. h. t. l. u. n. m. i. l. Th. e. h. e. a. r. t. i. t. d. m. t. b. l. y. l. g. d. n. t. h. t. a. Th. g. h. t. a. d. l. p. u. l. f. b. l. b. u. t. l. y. c. n. t. a. b. l. e. Th. y. t. l. p. u. e. S. a. t. h. e. t. t. l. p. r. e. r. o. t. b. e. u. t. e. l. y. i. t. e. r. m. i. n. d. I. n. t. h. l. i. f. t. a. m. t. h. e. b. l. o. d. p. e. u. S. o. o.

Thus on the human subject we have now a striking confirmation of the observations which Dr Reid and I have made upon the vorta of dogs.

Four or five times in the past twelve and a half years this most obliging of patients has

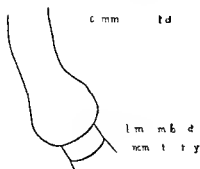


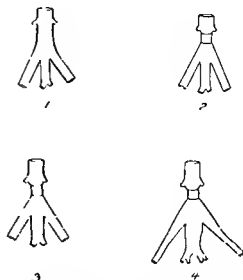
Fig. 3 Mrs B February 1998 Diagram made from Dr Red's measurements

journeued to Baltimore in response to my letters and nine years ago I made a note of the remarkable manifestation — a cylindrical dilatation of the common carotid throughout its entire length. But not until this year did the explanation of the phenomenon occur to me. Although for many years I have pondered the subject of the dilatations distal to the point of constriction in cases of cervical rib and four years ago observed for the first time a dilatation of the aorta distal to a partially occluding band in the dog (Plate 1). How true it is for some at least that facts may almost smite us in the face and still pass unobserved.

In the analysis of 523 clinical cases of cervical rib we found 106 in which the subclavian artery had been compressed and that in 7 of these aneurism or dilatation of this vessel distal to the site of constriction had been noted. Interesting illustrations appear in the papers of Keen<sup>1</sup> and Law (Figs. 4 and 5).

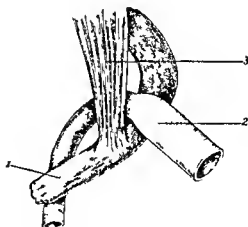
DILATATION OF THE HEART IN CASES OF  
ARTERIOVENOUS FISTULA

A particularly interesting result of our clinical and experimental studies of arterio-venous fistula is the discovery that enlargement of the heart probably occurs after a time as a rule in the major cases. My attention was forcibly called to this complication some ten years ago by a case of fistula of the femoral vessels which I saw in consultation with James F. Mitchell of Washington and



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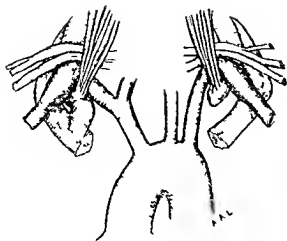
upon which together we operated in the Providence Hospital. The phenomenal enlargement of the heart must I thought have been due to the fistula and have been secondary to the enormous dilatation of the aorta and venæ cavae. Since then we have more carefully noted the condition of the heart in our cases of arteriovenous aneurism and have I believe quite invariably found



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the heart enlarged strikingly in several instances

If the assumption is correct that the heart dilates in consequence of the fistula it is important that the fact should be brought to the attention not only of surgeon but also of pathologist and internists who apparently have overlooked it. Dr Mont Reid has in preparation a report upon his experimental and clinical work in arteriovenous fistula in which he will offer convincing experimental proof of our view that the fistula may in its consequences profoundly affect the heart as well as the vein and artery. and Dr Cure L. Callender is making a careful study of all the reported cases of arteriovenous fistula in order to weigh the clinical evidence bearing on this subject which the record may furnish.

When a causative relationship between arteriovenous fistula and dilatation hypertrophy of the heart has become so convincingly established we may find that some unexplained dilatations of the heart are referable to hitherto undetected changes in the wall and lumen of the blood vessel. That a very considerable dilatation of blood vessels may be overlooked at autopsy, our experiment in the partial occlusion of arteries has convinced us. It is impossible to estimate the amount of dilatation of either an artery or vein in their collapsed state. Arteries as well



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as vein which when empty give no indication of increase in caliber may on injection prove to have been markedly dilated. All surgeons know how true this is of veins. A vein to which when full of blood von Langenbeck in deference would as he said remove his hat might when empty be hardly recognizable in the course of an operation.

There may be more or less circumscribed aneurysmal expansion in the continuity of the otherwise cylindrically dilated proximal arterial trunks. I have observed this in two or three of my patients. One such expansion is shown proximal to the fistula in the post mortem specimen of a famous case reported by Oler (Fig. 1) and another in Einbrey's

O l W m C f d m f h l l y  
l l A H r s m f h g i h l x f h y  
l k l l L L n l S b A f d t  
p E x h A B A j l e u m f h p e f l f m l  
l J A m l A j l



Fig. 11. Dilatation of the carotid artery and vein proximal to a fistula of 30 years duration. SAM, salivary gland; ant. mus. cl., anterior muscular; BP, brachial plexus; B.P., brachial plexus; C.V., cervical vein; T.T., thoracic tracheal artery; (Reproduced by the courtesy of Sir William Osler and the editor of the *Lancet*.)

particularly instructive illustration (Fig. 6). I am quite sure that in Osler's case there was a much greater dilatation of the artery above the aneurism and between the aneurism and the fistula than the drawing indicates for as I have said one cannot judge of the size of the lumen from the appearance of the empty vessel. It would interest Sir William to compare the very similar drawings illustrative of the two cases, his own and Eisenbrey's as the latter's proves that the fistula may be a considerable distance below the point at which the artery has become conspicuously dilated and thus offers strong presumptive evidence that the reason why the specimen of the former lacks the evidence of the fistula is because it was too greatly

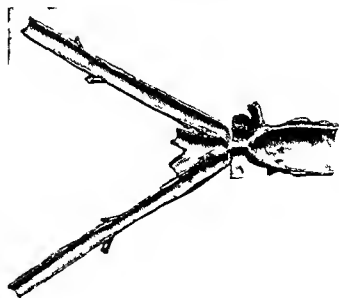


Fig. 8. Complete occlusion of the carotid artery of a dog by a metal band. Note the absence of dilatation below the band 7 months after its application. (Reproduced by the courtesy of the editor of the *Journal of Experimental Medicine*.)

curtailed by the pathologist. The pathologist by the way should not be too harshly censured for missing the key to the situation for if perchance he had been aware that the artery should be dilated central to the fistula he could hardly by any possibility have known that it might retain approximately its normal caliber for a distance so far from the arteriovenous communication.

Thanks to the assistance of highly competent secretaries I have abstracts of 380 cases of arteriovenous fistula. These have been studied with especial reference to occasional observations on the dilatation of the artery. In 5 instances proximal dilatation of the arterial trunk has been noted. In 11 dilatation was mentioned but whether proximal or distal or both is not specified. I am quite sure that in almost every instance in which the fistula had existed two or more months proximal dilatation of the artery would have been ascertainable if looked for. The size of the involved artery both above and below the fistula should always be compared with that of its fellow. The dilatation in the older cases extends as a rule probably to the heart which also in my opinion is quite likely as I have said to be dilated. The size of the narrowed artery below the fistula may



Fig. 1. The aorta showing the band and the dilatation distal to it. (H. J. D. R. D. Loc. 1)

be difficult to determine without dissection. In view of our observation it would be well also to be in mind the possibility of a dilatation of any great artery distal to the site of ligation and the probability of such dilatation if perchance the lumen were in some measure reestablished. As the dilatation distal to a totally occluding ligature has been observed by us only in dogs and only in the aorta and its trunk of branches further experimentation is necessary for the determination of the part played by other possible factors—for example, by the anastomotic circulation and by the proximity of the nerve trunks—by the length of the dead arterial pocket in other words.

In a previous paper I made the statement that dilatation had not been observed below a totally occluding band (Fig. 5). Since then, however, a slight degree of dilatation distal to the completely occluded vessel has taken place in three instances. A dilatation of the ventricle-like portion of the aorta between the band and the trifurcation might be ex-

H. J. D. R. D. (Loc. 1)

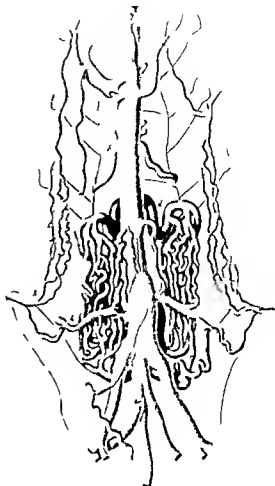


Fig. 2. The aorta showing the band and the dilatation distal to it. (H. J. D. R. D. Loc. 1)

pected even in case of complete occlusion for the anastomosis is very free in this situation and the dead pocket is usually and perhaps always too short to become obliterated. Lumbar branches may be given off just below a band, as they are just above the band.

In two instances I have made the following observation in the living, during the life of the animal for the patency of the aorta under the band. I re-ure with the finger immediately above the band shut off the pulse in what we term the ventricle where is pressure with the back of the scalpel blade made a closure to the band as possible did not. In these cases there was patent lumbar artery so close to the edge of the band that pressure by it obliterated it whereas

the knife blade which could be brought to bear on the aortic wall between this little artery and the upper edge of the band did not interrupt the flow in this important anastomotic branch. The contribution of this little artery to the anastomotic blood stream was sufficient to convert an impalpable into a palpable pulse. A palpable pulse in the ventricle below the band is so invariable whether the aorta has been completely occluded or not that the patency of the artery under the band cannot be definitely determined during the life of the animal unless temporary occlusion of it between the band and the nearest lumbar artery obliterates or decidedly influences the pulse in the ventricle. If pressure above the band does not affect the pulse just below it we may conclude that obturation is complete.

Fortunately it occurred to me a few days ago to restudy with reference to the possibility of finding depicted a dilatation of an artery below a ligature the sketches of surgeons who in bygone years had experimentally ligated the blood vessels of animals. I was delightfully surprised to find in the beautifully illustrated volume of Luigi Porta<sup>1</sup> published in 1845 two drawings which portray a pronounced dilatation of the aorta and its ventricle immediately below the site of ligation (Figs. 9 and 10). The ligatures in the two dogs had been applied 8 and 15 months before the death of the animals. There is a great bundle of dilated vessels—the vasa vasorum—bridging the gap between the retracted ends of the dilated aorta.

Thus three quarters of a century ago this great perhaps the greatest surgeon of Italy furnished irrefutable proof of a remarkable phenomenon which must eventually have interest for the physiologist, the pathologist and the surgeon. Luigi Porta describes the drawing but makes no further comment upon the dilatation.

Before the introduction of antiseptic surgery by Lister thrombosis quite invariably followed ligation of an artery and it was to the organization of the thrombus that the surgeon looked for the prevention of secondary

hemorrhage and for the preservation of the life of the patient. If thrombi formed in these two cases of Porta they must have been eventually absorbed for the distribution of the dilated vasa vasorum proves that the aortic stumps were patulous and we have further proof of this in the dilatation of the aortic ventricle just below the site of the ligation.

In the course of my experiments in partial occlusion of the arteries I have often studied the illustrations carefully. I thought in Luigi Porta's work but not until I scanned them with the particular object in view did I discover the dilatations so strikingly manifest. I doubt if anyone has ever commented upon or been interested in these two observations of Porta.

The following summary is quoted from a paper presented before the National Academy of Sciences in April of this year.

#### SUMMARY

1. A partially occluded artery (abdominal aorta, innominate carotid, subclavian) may dilate distal to the site of constriction.

The dilatation is circumscribed and has been greatest when the lumen of the artery (the aorta) was reduced to about one third or perhaps one fourth of its original size.

2. When the obturation has been slight in amount dilatation has not been observed of 7 cases of complete obstruction there was a very moderate degree of dilatation in 3 and none in 4.

3. Complete or partial occlusion of the thoracic aorta may be followed by dilatation central to the point of constriction.

4. Dilatation or aneurysm of the subclavian artery had been observed twenty even or more times in cases of cervical rib.

5. The dilatation of the subclavian is circumscribed, is distal to the point of constriction and strikingly resembles the dilatation which we have produced experimentally.

6. The dilatation of the artery proximal to an arteriovenous fistula and distal to a partially occluding band may prove to be referable to the same cause.

7. When the lumen of the aorta is considerably constricted the systolic pressure may be permanently so lowered and the diastolic

<sup>1</sup> L. G. I. rt. D. ill. it. p. t. l. g. b. d. ill. p. a. l. l. g. d. s.  
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pressure so increased that the pulse pressure may be diminished by one half.

9 The experimentally produced dilatations and the aneurisms of the subclavian artery in cases of cervical rib are probably not due to motor paralysis, trauma or sudden variations in blood pressure.

10 The abnormal whirlpool like play of the blood in the relatively dead pocket just below the site of the constriction and the lowered pulse pressure may be the chief factors concerned in producing the dilatation.

11 Band or tied ever so tightly do not rupture the intima.

12 Intimal surfaces brought however gently in contact by bands or ligatures do not in our experience unite by first intention for the force necessary to occlude the artery is sufficient to cause necrosis of the arterial wall.

13 The death of the arterial wall having been brought about by the pressure of the band a gradual substitution of the necrotic tissue take place the new vessels penetrating it from both ends. It is I believe in this manner that an artery becomes occluded and it is thus that a fibrous cord forms within the constricting band.

## A STUDY OF EMPYEMA CASES AT CAMP DONIPHAN

B. M. C. BINGHAM, M. C. and JOHN A. RODDY, M. C. and  
JOSEPH D. MONSON, M. C.

THE epidemic of pneumonia which existed in practically all military camps during the early part of the year 1918 was soon recognized as a serious situation. Many of the cases were complicated by empyema, the treatment of which has not been any too satisfactory. At once measures were adopted to curb this epidemic. The surgical complication gave evidence of the greatest possibilities. Consequently empyema teams were formed consisting of a surgeon, an internist and a laboratory worker appointed by the commanding officer at the suggestion of the Surgical Division from the personnel of each Base Hospital, the object being to stimulate more intensive study of empyema to insure better treatment and if possible to add something to our present knowledge of the condition. A concise review of the efforts from Camp Doniphan follows.—EDITOR.

In this hospital cases classified as empyema are those in which pus or exudate with bacteria exists in the pleural cavity.

From November 1917 to May 4, 1918 there were 148 cases; in November 16, December 42, January 4, February 1, March 10, April 11, May 6. Practically all

men affected were in the third decade of life and the average period of military service before admission to the hospital was three twelfths year.

Some of the regiments of the 35th Division were composed of men from urban and other from rural communities. Fifty-eight per cent of the cases of empyema came from regiments made up almost entirely of men from rural districts, 4 per cent from regiment composed of both urban and rural men and only 8 per cent from regiment of urban men.

### CLASSIFICATION

There were 11 primary cases in which signs and symptoms indicated the pleura as the first and principal site of disease without any evidence of recent or remote preceding infection of the respiratory tract, nasal, frontal sinus or systemic disease. The other 137 gave a history and many showed signs of recent acute rhinitis, laryngitis, tonsillitis or bronchitis and are therefore referred to as secondary.

**Onset.** The onset was sudden in 47 per cent, gradual in 34 per cent and insidious in 19 per cent of the cases diagnosed before death. There were 2 cases not recognized until

## 35TH DIVISION

O g zat	P rs Rur l U b	Numb C	P C t
137th Infantry	Pural	3	15 5
138th Infantry	St Louis	7	4 7
139th Infantry	Pural	27	18 3
140th Infantry	Mi ed	3	15 5
128th Field Artillery	St Louis		1 4
19th Field Artillery	Kan as City		1 4
130th Field Artillery	Ru al	6	4 0
18th Machine Gun Battalion	Rural	10	6 7
129th Machine Gun Battalion	Ru al	4	2
130th Machine Gun Battalion	Rural	0	0 0
110th Trench Mortar Battalion	Rural		1 4
110th Ammunition Train	Draft	5	3 3
110th Field Signal Battalion	Rural		7
110th En ineers	Mixed	9	6 0
110th Supply Train	St Louis		1 4
110th Sanitary Train	Rural	6	4 0
110th Military Police	Rural	3	0
Detachment Base Ho pital	Rural	4	
Au iliary Remount No 37	Mi ed	4	7
Field Bakery No 317	Regulars	1	
Field Bakery No 34	Pegulars	1	7
Casual Camp	?	1	7
1st Balloon Squad	?	1	7
39th Balloon Squad	?	7	7
1th Field Artillery	?	2	4
Total		48	00 0
Rural	N mb	86	P t
Urban		13	58 1
Mi ed		36	8 8
Unknown		13	4 3
Total		48	5 8
			100 0

autopsy. Sudden onset was most frequent in primary empyema (70 per cent) least frequent in empyema occurring after long illness with measles and pneumonia (14 per cent). Insidious onset was most frequently observed following measles and pneumonia.

In general the symptoms conformed with accepted descriptions. Pain in the chest referred to the region of breast or angle of the scapula on the affected side was the most constant most distressing and most suggestive symptom lancinating pain some times gradual more often sudden in onset accentuated by any movement especially by inspiration lasting in almost all cases for several days but in some throughout the disease.

This symptom was not present in all cases. In many it was no more severe than frequently met in pneumonia nor more prolonged

than in pleurisy without pus but in about 50 per cent of the cases it was the dominant symptom and suggested the correct diagnosis.

In a few cases constant dull pain diffused throughout the chest with no point of maximum intensity was found. In one case several days before the onset pain suggestive of acute periostitis of the tibia was reported. In four cases prior to development of pain or physical signs in chest there was severe pain in the abdomen with slight tenderness in the subdiaphragmatic area in two other cases pain and tenderness localized at McBurney's point was the first evidence of disease.

*Dyspnea* was not a symptom of diagnostic value. In the majority of cases terminating favorably it was slight and of short duration (several days). In some cases it was absent throughout the disease and whenever present this symptom had but slight diagnostic value.

## PHYSICAL SIGNS

The physical signs indicative of accumulation of fluid in the pleural cavity were all elicited but only occasionally before the end of the first week of the disease.

*Inspection.* Changes in contour and motion suggestive of fluid in the chest were observed in 5 per cent of the cases.

*Palpation.* Decrease in or absence of normal fremitus was detected in 76 per cent increased fremitus found in 9 per cent.

*Percussion.* Extreme dullness or flatness suggestive of fluid in the chest was elicited in 60 per cent of the cases. Changes in percussion sound caused by change of patient's position were noted in 5 per cent. Hyperresonance was elicited above the area of dullness or flatness in less than half the cases.

*Auscultation.* Pleural friction was heard in 15 per cent of the cases vocal and breath sound were diminished in 30 per cent and absent in 10 per cent over the site of fluid increased in 8 per cent and intensity not noticeably altered in the remainder.

## COURSE

Empyema occurred secondary to demonstrable infection elsewhere in the body in more than 90 per cent of the cases. Strepto

cocci alone were found in the pus from 132 of the cases pneumococci alone were found in 9 pneumococcus and streptococcus occurred together in 7

The course in favorable cases has been that of a localized severe streptococcus infection and in the fatal cases that of a streptococcus epicamnia usually with multiple foci of infection in adjacent or remote organs

There was leucocytosis which showed only slight fluctuations throughout the disease in practically all cases the lowest count was 12 000 the highest 40 000 average about 20 000 The polymorphonuclears always predominated in some cases constituting 95 per cent of the cell No distinctive difference in either the total or differential white cell count between mild and severe or between fatal cases and recoveries was found

In case of sudden and gradual on set subjective symptom (except dyspnoea) usually increased in intensity throughout the first 3 to 6 days gradually subsiding thereafter in favorable cases in the more severe cases after the first week a thenia progressed rapidly to a degree proportionately greater than the sign and symptoms would lead one to expect a more grave loss of vitality and resistance than observed in any other group of patients in the hospital Physical signs of fluid in the pleural cavity occasionally were fully developed during the first 4 to 48 hours but in most cases were not distinct until the third or fourth day and increased during the first week

#### TEMPERATURE

The temperature curve bore no relation to the gravity of the case in most instances

Cases of in idious on set and those developing after prolonged illness with measles purulent otitis media or pneumonia usually ran an evening temperature of between 101 and 103 with morning remissions of 1 to the remissions becoming greater even to 96 and the exacerbations to 104 or 105 toward the termination of fatal cases

When the on set was sudden or gradual the temperature curve was similar to that above described in about half the cases especially those terminating favorably In some of

the latter and most of the fatal cases toward the end the evening temperature often reached 104 to 105 and dropped from 3 to 4 in the morning an exaggerated pump handle curve

An irregularity of temperature curve suggestive of sepsis was apparent in nearly all cases usually slight but in some conspicuous

The temperature had no characteristic that would distinguish it as related to empyema in contradistinction to other infections with foci of suppuration

In connection with these cases one sign of value in the observation of all patients infected with streptococci was repeatedly observed in cases of localized streptococcus infection with little or no fever trivial or no symptoms and slight signs (in this series usually tonsillitis bronchitis pneumonia and otitis media in the stage of recovery) a sudden rise of temperature to 104 or 105 with or without malaise or headache indicates a new focus of infection 4 to 48 hours before other symptoms or signs indicated it

#### CHARACTER AND LOCATION OF EXUDATE

Repeated paracentesis and observation at time of operation disclosed the following

1 Cases aspirated early and repeatedly frequently yielded clear serous fluid the first one two or three days and thereafter cloudy crebrinous scrofulous or purulent fluid

The fluid aspirated in several cases immediately before operation was cloudy serous and when the pleura was opened due to the agitation of the fluid frank pus was obtained

3 In a considerable number of cases the first less often the second and in a few cases the third evacuation by aspiration at daily intervals yielded apparently sterile fluid and the next fluid withdrawn showed streptococci

4 Even when the physical signs indicated fluid frequently no exudate was obtained the first time a needle was introduced often three or four punctures were made before obtaining fluid similar though less numerous failures accompanied the use of trocar and cannula

5 In a number of cases the exudate was sacculated and in two fatal cases the empyema was bilateral

## COMPLICATIONS

*Pericarditis* with effusion developed in the course of the disease in 27 fatal cases. It was detected antemortem twice by the physical signs and in two other cases was indicated by X ray.

*Peritonitis* occurred early in four cases. Diffused peritonitis developed late in 1 other fatal case.

*Pneumonia* usually broncho developed before the end in nearly all fatal cases.

*Bronchitis* in some cases slight in some cases severe was present throughout the course of the disease in nearly all cases.

Postmortem findings indicate that grave pathological changes in the liver, spleen and kidneys were frequent complications but such were not detected during the progress of the disease.

*Diphtheria* During the period that empyema occurred 30 per cent of all patients admitted to the hospital were diphtheria carriers (throat or nose) and true diphtheria was a frequent occurrence. Following operations 58 of the patients usually the more severely ill at one time or another carried diphtheria bacilli in the nose or throat. Two of the cases were complicated by tonsillar diphtheria. Diphtheria of the wound complicated 5 cases 2 of which were fatal.

## DURATION, MORTALITY AND MORBIDITY

*Duration* One hundred and fifteen cases have been completed to date. Four cases not operated upon that terminated in recovery had an average duration of about 30 days.

Intercostal incision and drainage were made in 3 cases 1 patient recovered who was operated upon 28 days after the onset of the disease the other was discharged from the hospital 52 days after operation 2 were ill 8 days before operation 1 died 9 and one 40 days after operation.

Rib resection and drainage were done in 101 cases and 69 terminated in recovery. In these the average duration before operation was 2 days after operation 56 days. In the fatal cases the average duration of the disease before operation was 16 days and after operation 13 days.

## MORTALITY

	P	C	T
Total mortality	48	6	
Mortality not operated	9	0	
Mortality intercostal incision and drainage	66	66	
Mortality rib resection and drainage	31	8	

The right side was more frequently affected than the left 85 to 60 and the mortality was greater among right sided cases than left 67 to 36 per cent.

Two were bilateral cases one was operated upon but both died.

Mortality of cases operated upon according to character of exudate was as follows:

	P	C	T
Serous	74		
Seropurulent	80	2	
Purulent	58		

In 101 cases operated upon there was a note made showing how many days after the development of lung symptoms e.g. bronchitis broncho or lobar pneumonia pus was found in the chest. There were in

	P	C	T
to 5 days 25 cases with deaths mortality	48		
6 to 10 days 24 cases with 6 deaths mortality	33	3	
11 to 15 days 17 cases with 5 deaths mortality	9	4	
16 to 20 days 3 cases with 3 deaths mortality	23		
21 to 25 days 5 cases with 2 deaths mortality	4		
26 to 30 days 3 cases with 1 death mortality	33	3	
31 to 40 days 2 cases with 0 death mortality	00		
40 plus days 6 cases with 0 death mortality	00		

With the exception of from 21 to 30 days in which time there were but 11 cases the mortality was progressively higher in those developing empyema early in the disease.

Of those who died following operation

2 died between 1 and 5 days after operation	
10 died between 6 and 10 days after operation	
3 died between 11 and 15 days after operation	
4 died between 16 and 20 days after operation	
1 died between 21 and 25 days after operation	
1 died between 26 and 30 days after operation	
4 died between 31 plus days after operation	

The average number of days after operation was 14.8. Of those who recovered and were discharged from the hospital

3 left between 0 and 30 days	
7 left between 31 and 40 days	
7 left between 41 and 50 days	
4 left between 51 and 60 days	
3 left between 61 and 70 days	
2 left between 71 and 80 days	
4 left between 81 and 90 days	
0 left between 91 and 100 days	
0 left between 101 and 110 days	
1 left between 111 and 120 days	
1 left between 121 plus days	



The average time of discharge following operation was 58.3 days. There are 35 cases remaining in the hospital.

**Morbidity.** Convalescence is more than three months in duration in all cases and not one has been found with full restoration to health. Of those finally released from the hospital 8 have been readmitted with recurrences and not one has been able to resume a full duty status. It is very doubtful if any of these patients will become fit for a full performance of duty as a soldier within 6 months after operation and the majority undoubtedly never will.

#### DIAGNOSIS

In primary empyema (not preceded by other disease) changes in physical signs, symptoms and blood count disclose the diagnosis. About half the cases were secondary to pneumonia: 59 complicating primary lobar pneumonia, 17 primary broncho pneumonia, 14 lobar pneumonia secondary to other diseases, 18 bronchopneumonia secondary to other diseases. In this important group we failed to detect the presence of fluid by physical signs in about one third of the cases and white cell counts had no differential diagnostic value.

Paracentesis was deceptive when a fine needle and syringe was used. Single punctures with needle or trocar and cannula were also misleading.

By making multiple punctures with trocar and cannula the presence and character of the fluid was discovered in over 80 cases.

X-ray plates distinctly showed the presence of fluid in all but 6 cases submitted to this form of investigation. In the 6 exceptional cases the plates were suggestive but not conclusive.

In practically all cases differential diagnosis of empyema from pleurisy with effusion required aspiration of fluid and bacteriological examination. Whenever clear or cloudy serous fluid contained streptococci 1 to 3 days later the exudate was typical pus. Frequently when the first fluid obtained was serous and showed no bacteria a later specimen showed streptococci.

From our finding in these cases we believe

early diagnosis essential to best results require.

1 Careful physical examination of chest daily in all cases of streptococcus infection regardless of its location.

2 Immediate and repeated X-ray examination of chest when severe continuous pain is referred to chest and though other symptoms and signs suggest disease elsewhere and in all cases of pneumonia of prolonged and otherwise atypical course.

3 Exploratory punctures with medium sized trocar and cannula should be made in every case and repeated in every case several times if fluid is not obtained.

4 Total differential leucocyte counts and thorough bacteriological investigation of fluid withdrawn.

#### ETIOLOGY

Measles *per se* does not appear to be a predisposing factor. Out of more than 1600 cases of measles without other complications there were only 9 cases of empyema. In 224 complicated cases of measles the most frequent complication was pneumonia lobar 59, broncho 14.

The most favorable subjects for the development of pleurisy with effusion and empyema were those who suffered with pneumonia complicating or following measles. Pleurisy with effusion developed in 1 and empyema in 11 of 59 cases of lobar pneumonia complicating or following measles, effusion in 8 and empyema in 1 of the broncho pneumonia following measles. From this it appears that measles is more frequently followed by pleurisy with effusion than by empyema. That empyema is more apt to follow pneumonia than measles is apparent when we compare its incidence in primary pneumonia 11 per cent in 53 cases while in 1600 cases of measles the incidence is 0.56 per cent.

The most important predisposing cause and it would seem almost an essential factor in the occurrence of the majority of cases of empyema is a marked reduction in the normal immunity or resistance to disease from any cause conspicuous among which have been prolonged illness, undue exposure to cold and unusual fatigue.

Direct evidence as to the atrium of infection or route by which streptococci gained access to the pleura was not found but it appeared that the organism first entered the body through the respiratory tract

There is no evidence that empyema directly resulted from transmission of infection from one person to another

#### TREATMENT

This disease was not influenced by any form of medication and the conditions under which serum treatment was administered subcutaneous intravenous and intrathoracic permit no conclusions but results were not encouraging

Absolute rest throughout the disease should be very efficacious and is now one of our most studiously observed practices in all cases of streptococcus infection This with maximum nutrition early recognition of empyema and speedy delivery of patient to the surgeon is the most the physician can do

A very small group of milder cases of empyema tend to spontaneous recovery and progress to a favorable termination without medication operation or treatment other than nursing Another small group recovers after repeated aspiration

It was early discovered that attempts to differentiate cases of the above character from those requiring resection and drainage were futile and disastrous and that best results require resection and drainage

Later it became evident that the earlier in the disease this operation is performed the better are the patient's chances for recovery

When a case is diagnosed empyema by the medical service and the condition confirmed by the laboratory these cases are transferred to the surgical service and drainage of the chest immediately established Two surgical wards were assigned for empyema cases exclusively, all diphtheria carriers being isolated in one ward In this carrier ward beds were separated by sheets and ward attendants and ambulant patients wore masks

The operation of choice in this series of 104 cases was rib resection seventh or eighth preferably in the postaxillary line or farther posterior so that when the patient is lying

on his back the drainage is dependant A few cases have required drainage farther anterior or where pus has been found with a needle

One case was an inter lobar accumulation the others with few exceptions were typical pleural accumulations a few sacculated by fibrinous adhesions We have found at operation none of the substernal pockets described in the Camp Funston report

Thoracotomy was not considered a desirable operation for the reason that drainage was not as free as in a rib resection It was more difficult to retain the tubes in place and they have a tendency to close too rapidly Often the ribs are so close together that the insertion of a tube is difficult

#### ANÆSTHETIC

It would seem that the anæsthetic used had little if any effect upon the ultimate outcome of the case Ether was used in 76 cases 25 of these died later a mortality of 32.9 per cent Nitrous oxide and oxygen were used 18 times 6 died later a mortality of 33.33 per cent Cocaine anæsthesia was used but 4 times with 2 deaths a mortality of 50 per cent Chloroform was considered a more dangerous anæsthetic so was used but 3 times with 1 death mortality 33.33 per cent In 3 cases there was no record of the anæsthetic used with 1 death in this series

Nitrous oxide was considered the most satisfactory in that the patients were quickly anesthetized but little gas was necessary and the recovery prompt with the patient in excellent condition Caution is necessary however as the patients easily become cyanotic due to the fact that a large part of the lung tissue is not functioning

Ether is satisfactory and safe Lung cases require but a small amount of anæsthetic to maintain complete anæsthesia (1 ounce was the average amount used for all operations) The average length of time for all rib resections was 7 minutes and 15 seconds This small amount of ether surely cannot be considered as deleterious and was considered preferable to a local anæsthetic with which there was always some pain nervousness and often restlessness on the table

Of those who recovered drainage with rubber tube was maintained for a variable period averaging 3 weeks the wound closing about weeks later. A number of cases required reopening as shown by elevation of temperature and fluoroscopic examination. In the the original incision was either incised or forced open with a haemostat and a tube inserted or a rib resection was done posteriorly better to drain a cavity.

Carrel Dakin solution was used in 35 case from 4 to 6 weeks. The consensus of opinion here is that it is not beneficial. There was no particular change in the temperature or pulse. Many of the patient complained of cough which was very annoying. After to 3 week use of the solution there was not a very appreciable change in the bacterial count from the wound. A few of the cases which were closed after a count was made of 5 to the field for 5 days had to be reopened. The patient were kept in bed and disturbed every 2 hours while they would otherwise be up and around. It was felt that the pressure of the fluid between the lung and the chest wall favored collapse of the lung and increased the size of the cavity as well as causing infection in the dependent portion of the chest by gravity. A series of half the patients in one ward was kept on the solution while the remaining half was not. Those without the Carrel Dakin solution seemed to improve more rapidly. There was no appreciable diminution of the discharge nor of the odor.

In the after treatment suction was not used in the chests. The blowing of water from one bottle to another was used and found beneficial. The patients who were able to do so were given careful and systematic sitting up exercises and all were kept out of doors and in the fresh air as much as possible.

#### LABORATORY STUDIES

Laboratory studies were undertaken with the view of determining the etiological factors concerned in the production of the empyema. Cultures were made from the nose, throat, blood and pleural exudate. Studies were made of the blood to determine the value of leucocyte and differential counts and whether the presence or absence of agglutinins aided

in arriving at a diagnosis or prognosis.

**Tonsils and nasopharynx.** Cultures from the tonsils and nasopharynx of pneumonia and empyema cases were not systematically studied but in the course of a survey for meningitis made from January 1, 1918 to March 1, 1918, cultures were taken from the nasopharynx with the result that about 60 per cent of the cultures showed the presence of a hemolytic streptococcus in apparently normal individuals. The incidence of streptococcus hemolyticus was most marked during the month of January when certain organizations showed as high as 50 per cent hemolytic streptococci in their cultures. Cultures were taken from the nasopharynx and tonsils of 36 empyema cases. Agglutination reactions carried out with 9 strains isolated from the tonsils of these cases using sera from empyema cases showed no constant reaction between the strain isolated from a given case and the serum from that same case.

**Blood.** Blood cultures from 37 cases of empyema showed streptococcus hemolyticus in 1 case or 2.7 per cent. This positive culture was obtained about 72 hours before death. Repeated cultures were not made.

L	oc	C	N	mbe	P	C
oo	t	ooo		6		57 8
	1					
ooo	t	3 ooo		4		8 2
3 ooo	t	ooo				
T t t				45		oo
Dff t IC						
6 1	p	lym r t	1	11	7	6 6
7 1	So	polym ph	1	11		8 6
20 1	g	p	lym t h	1	9	4 2
9 1	95	p	l m f l	1	4	9 6
T t t					4	oo

Of the remaining forms of leucocytes nothing noteworthy was found.

**Sputum.** Of 18 sputa examined from patients who later developed empyema 11 or 61.1 per cent showed streptococci and 7 or 38.9 per cent showed pneumococci of which proved to be type 1. Of the remaining 5 no attempt was made to determine the type.

**Urine.** Of 60 specimens examined at various stages of the disease 7 showed the presence of albumin while 10 showed casts and albumin.

*Pleural Exudates*

Ch t (fl d	N mb	P C t
Serous	3	13
Seropurulent	83	61
Purulent	4	84
Total	148	100 0

The serous fluid was obtained in the early stage and was transformed into a seropurulent or purulent later in the course of the disease. The seropurulent or purulent fluid permitted to stand for any length of time soon separated into an amber colored supernatant layer usually clear or slightly cloudy and a grayish white layer in the bottom of the tube consisting of fibrin and pus cells.

Exudates from which pneumococci were recovered were thick of a grayish white or creamy color and did not show the distinct separation into layers as evidenced by the exudates from hemolytic streptococci.

Organism	N mb	P C t
<i>Streptococcus hemolyticus</i>	13	92 5
<i>Pneumococcus</i> type 1		4
<i>Pneumococcus</i> type undetermined		4
<i>Streptococcus dans</i>		4
Total	148	100 0

## BACTERIOLOGY

*Pneumococcus* The diagnosis was based upon the morphology bile solubility inulin fermentation and a greenish zone about the colonies when planted upon blood agar. In two cases type 1 pneumococcus was obtained from the sputum and from the pleural exudate and from the same case. It was noted that hemolytic streptococci were recovered from these same cases after they had been in the ward with other empyema cases for several days.

*Streptococcus viridans* Diagnosis was based upon the characteristic appearance upon blood agar bile insolubility and non fermentation of inulin.

*Streptococcus hemolyticus* Studies were made of 58 strains isolated from pleural exudates of empyema cases as to their morphology hemolytic properties and inulin fermentation.

*Broth* After 24 hours incubation there was slight clouding of the medium with a

fine granular sediment present at the bottom and along the sides of the tube. Microscopic examination revealed a chain of streptococci ranging from 20 to 40 organisms to the chain.

*Blood agar* After 8 to 12 hours incubation a beginning zone of hemolysis was manifest about the line of inoculation which at the end of 18 to 24 hours was distinct measuring from 3 to 5 millimeters in diameter but in some strains the degree of hemolysis was still more marked giving rise to a zone measuring about 6 to 8 millimeters in diameter.

*Inulin* None of the strains studied fermented inulin after 5 days incubation.

Of the 148 cases 7 died a mortality of 48.6 per cent. The organisms found in these cases were

	N mbe	P C t
<i>Streptococcus hemolyticus</i>	68	94 4
<i>Pneumococcus</i> type 1	1	1 4
<i>Pneumococcus</i> type undetermined		8
<i>Streptococcus viridans</i>	1	1 4
Total	72	100 0

## POSTMORTEM EXAMINATION

Postmortem examinations were made on 50 cases.

Ch ac (fl d F t	N mbe	P C t
Serous	3	6 0
Seropurulent	39	8 0
Purulent	9	1 0
Total	50	0 0

*Adhesions* Adhesions were marked on the affected side in all cases examined and especially so in the cases where drainage had been instituted. Distinct pus pocket formation was most frequently found near the opening in the chest wall. These pockets usually contained small quantities of pus.

When larger pus pockets formed they were usually some distance above or below the drainage opening. Other locations of walled off pus were as follows: between pericardium and lung 3; substernal between the lobes of lung.

*Pericarditis*

Ch act (fl d	N mbe	P C t
Serous	11	4 7
Seropurulent	14	5
Purulent	2	9
Total	27	100 0

*Pericarditis*

Ch	t	IT	d	N mb	P	C	t
S	1	1	t	9			
P	ul	t		3		5	
	T	t				∞	

It is seen that 1 case had a general pericarditis while 15 had only a pericarditis.

*Lungs*—An extensive bronchopneumonia was noted in 45 cases while in 13 cases the process was not so marked. In cases of lobular pneumonia was found.

*Lobular pneumonia* showing the irregular patches of consolidation was found in 5 cases. The consolidated patches were red elevated in all surrounded by small area of air constricted tissues. Microscopically a peribronchial infiltration with polymorphonuclear cells and some round cell was noted. The alveoli were filled with numerous polymorphonuclear cell and some blood cell. The interalveolar vessels was markedly congested and small hemorrhagic area were scattered throughout the section.

*Interstitial pneumonia*—In a series of 13 cases a gross appearance of the lung showed a distinct difference from that seen in the lobular pneumonia described. The part involved presented a mosaic appearance produced by thick bands of grayish white connective tissue which surrounded lobule of dark reddish blue colored collapsed lung tissue.

Microscopic examination shows the alveoli filled with numerous epithelial cells which are undergoing degeneration and with polymorphonuclear cell. Peribronchial infiltration with round cell and polymorphonuclear cell were noted as well as interstitial infiltration of the bronchi with round and connective tissue cell.

The two cases of lobular pneumonia showed the characteristic appearance of that disease.

A well marked peribronchial adenitis was noted in 30 of the 50 cases studied.

*Other complications*—Multiple abscesses of the spleen were noted in three cases. In three cases occurred well marked hemolytic purpura in one endocarditis and petechial hemorrhages upon the serous membrane. Acute ulceration was noted in two cases.

## AGGLUTININS

An attempt was made to determine the presence or absence of specific agglutinins and to ascertain by means of agglutination reaction whether the type coccus isolated was the same in all the cases considered. With that purpose in view cross agglutination experiments were carried out using 17 strains of hemolytic streptococci and 41 sera obtained from empyema cases. To each culture was added serum obtained from the same case from which the culture had been isolated.

Of the 17 cultures so studied 8 strains agglutinated by the patient's serum from which the cultures were obtained. Nine cultures were not agglutinated by the same serum but by serum from other cases.

Following are the results obtained using 1:10 dilution of the sera from the 41 cases studied and 17 strains of streptococcus hemolyticus isolated from empyema cases.

17	1	t	d	b	34
17	1	t	d	b	9
6	1	t	d	b	4
17	1	t	d	b	
17	1	t	d	b	
17	1	t	d	b	a
17	1	t	d	b	
3	1	t	d	b	
17	1	t	d	b	6

The serum obtained from empyema cases showed the following agglutination reaction in dilutions of 1:20

8	1	t	d	t	
	1	t	d	t	5
4	1	t	d	t	
	1	t	d	t	3
6	1	t	d	t	
3	1	t	d	t	4
	1	t	d	t	in
1	1	t	d	t	8
3	1	t	d	t	19
	1	t	d	t	
	1	t	d	t	
	1	t	d	t	4
	1	t	d	t	5

No attempt has been made to immunize animals against each strain of hemolytic streptococcus recovered.

## SUMMARY

1. The high incidence of streptococcus hemolyticus in the tonsils and nasopharynx of normal individual during the period when

streptococcic pneumonia and empyema were prevalent was observed.

2 Blood cultures show the presence of organisms late in the disease in grave cases only as a rule. A positive culture is a most unfavorable prognostic sign.

3 The pleural exudate obtained from empyema cases from which hæmolytic streptococcus was recovered showed a distinct difference in its physical characteristics in the majority of cases from the empyema fluid from which the pneumococcus was recovered.

4 The streptococci recovered showed the same morphological and cultural character

istics but the irregularity of serological reactions does not permit one to draw definite conclusions as to their belonging to the same group.

5 Agglutination reactions with patient's serum is of no diagnostic value because of irregularity of reaction with streptococci.

6 Postmortem findings in cases presenting both pneumonia and empyema caused by streptococci showed in most cases distinct lobular pneumonia in a number of cases the interstitial form of pneumonia especially in the cases of patients who had been ill for a long time.

## EXTRA-UTERINE PREGNANCY FOLLOWED RESECTION OF THE TUBE AND INSULATION OF CAIGUT TO KEEP IT OPEN<sup>1</sup>

By E. HASTINGS TWEEDY, F.R.C.P.I., DUBLIN, IRELAND.

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THE specimen which I here described consists of a pregnancy formed in the ampulla of the right tube of a patient who on two previous occasions had had this tube resected. Her history is briefly as follows:

Admitted to Steven Hospital in May 1913. She was operated upon by abdominal section for fixed retroversion with very firm adhesions which bound the uterus to the intestine. Both tubes were affected. The isthmus of the right tube was occluded by several hard concretions. The lower portion of the tube was removed and an end-to-end anastomosis was performed. A note in my book at the time suggests the possibility of relapse because of the extent and length of the tube broken down. In August 1916 she again came under my care in the Rotunda Hospital. She complained of backache, menorrhagia and tenacity. The uterus was again retroverted and fixed. The second operation proved easier than the first for the adhesions were neither so extensive nor so dense. The left tube seemed healthy but on the right side, where the end-to-end anastomosis had previously been done, there was no true union. The stump lay at right angles, one to the other and the orifices at both sides were completely closed. The occluded portions were cut away and a piece of chromicized fine catgut was passed through the fibrotic end of the tube and also through the uterine stump into the uterus. The uterine stump was then drawn

through the fibrotic extremity and stitched in position. The ampulla thus lay over the uterine stump in the form of a ferrule or cap. The left tube was not interfered with. In February 1917 the patient returned to the Rotunda Hospital suffering from pain in the side and irregular hemorrhages. The uterus was again retroverted. On opening the abdomen some posterior adhesions were easily broken down by touch and the right tube liberated and brought into the wound. Its outer third was swollen into a round tumor about the size of a plum. Its fibrotic extremity was open but much constricted. A probe could easily be passed through the tube into the uterus. It was impossible to say what this plum-shaped lump consisted of and it was deemed advisable to remove it. Dr. Boxwell who kindly examined the specimen had no difficulty in declaring it a tubal pregnancy.

A further experience in the treatment of sterility has served to confirm my former estimate that in 50 per cent of women sterile in spite of curettage the cause will be found to lie in tubal disease. There is reason to believe that occlusion of the tubes may be present without any apparent abnormality for I have in mind one woman with apparently normal tubes who became rapidly pregnant for the first time after the tubes had been blown up with air though previous to this she had been

twice curetted and had undergone much local treatment without result.

It is rare to find the fallopian tubes diseased throughout their entire lengths some times the ampulla alone involved and when it is diseased the ovary almost always shares in the adhesion in which it is embedded. On other occasions the ampulla and isthmus how gross disease more rarely the isthmus is involved and contains numerous solid concretions while the ampulla and intra uterine portion are both free from disease. In whatever situation the disease is found it is always evident that a complete barrier to conception is present and no treatment which fall short of the surgical opening of the lumen of the tubes can be of any possible benefit in the relief of sterility.

In respect to operative interference it must be confessed that salpingectomy as at present practiced has yielded very disappointing results this is entirely due to an imperfect technique and should not be held as a contra indication to the operation.

The amputation of the tube with or without tapering of the raw stump has been in the cases I have had an opportunity of re-examining invariably followed by complete occlusion at the stump.

Again in the present case the extremities of the tube were brought together by end to end anastomosis and the two portions were found adhering at right angles one to the other with complete closure of both stump orifices.

I have found the imbricated extremity again closed after previous opening and I have found the artificially formed os closed. In a case where the ovary was pressed into the split ampulla the ovary became surrounded with a membrane which covered the mouth of the tubes and prevented ovulation.

Demonstrated failures after recognized devices induced me to adopt the catgut bougie as a means of keeping open the tube lumen. In spite of discouragements from my friends I have always believed that in this device there is a solution of the difficulty. At first the catgut was applied in a rough and imperfect manner by passing a threaded

needle for a certain distance down the fallopian tubes and then bringing the needle and suture out through its wall. This technique is very faulty and will certainly result in tube occlusion at the site of the sutures exit. It is impossible to guide an ordinary piece of unthreaded catgut into the tube and a probe passed down to enlarge the lumen is liable to make for itself a false passage — a very undesirable complication. Chronic gut is stiff and unyielding and I employed it because these properties enabled me to pass it without any extraneous aid.

The critical period for closure of the tubes is comprised within the first three days after operation while peritoneal exudation is poured out and adhesions are rapidly forming.

It seems certain then that no good object is effected by retardation in absorption of the gut. On the other hand it is probable that the retention of the gut for many days in the tubes is harmful. The ciliated epithelium can hardly escape injury and the irritative effect which it must exercise on the muscle layers of the tubes will be still more important. It seems to me certain that these muscle bundles by their peristaltic contractions must be the force which enables the ovum to reach the uterus and I feel sure that an arrest of their peristaltic wave is an important factor in the occurrence of tubal pregnancy.

After many unsuccessful efforts I discovered a plan which enables me to place ordinary soft catgut in the tube. I thread a long fine Glovers needle permitting the catgut to pass the eye by only one quarter of an inch. The blunt side of the needle carrying the ligature is inserted through the lumen of the tube into the uterus or as far down as seems expedient. The thread is then pulled until it is felt to have left the eye the needle is then gently withdrawn while the gut remains in position.

Silk worm gut could it be used would be free from the fear of exciting a chronic salpingitis but were it employed there must be some method perfected for its removal.

I now possess a long fine probe eyed at one end and by its use I am sometime able to pass the gut into the uterus and out through

its wall. If it were possible to pass it through one layer of iodoform gauze previously inserted into the uterus the needle would carry the ligature after it either through the wall of the uterus or better still it might be passed through the lumen of the opposite fallopian tube and could be pulled out on removal of the gauze.

In many cases it is impossible to bring the fundus of the uterus through the abdominal wound and unless this were accomplished the needle which I show could not pass through both tubes but it is always possible to force it through the uterine wall and there seems little practical objection to this. One end of the gut should be cut flush with the serous wall of the uterus and the other buried in the substance of its corresponding ovary.

A plan such as this could be tried before the termination of an operation and in the event of its failure the catgut method would still be available.

The strange features in the case I show are that the tube which had apparently become normal still failed to function and to permit the passage of spermatozoa while the artificially dilated tube gave free access to the spermatozoa but could not transmit the ovum.

Blair Bell has reported a very interesting case where pregnancy followed his removal of the uterine end of the tube and the stitching of its fimbriated end into the cornu of the uterus. His success suggests the importance of making the passage through which the ovum has to pass as short as possible and this shortening of the tube

will enable the gut to be passed through it with greater facility.

It is impossible to trace my hospital cases but in my private work I have seen no woman pregnant after tube resection which involved the removal of the ampulla and my present opinion is that the latter plays a most important role in the guiding of the ovum to the uterus.

#### CONCLUSIONS

To summarize my conclusions

1 Salpingitis with or without apparent occlusion of the tubes constitutes a very usual cause of sterility.

Ordinary tube resection with or without the formation of an artificial os fails in almost every instance to provide a permanent passage to the uterus.

3 Failure to transmit the products of conception may be present in a tube which shows no gross abnormality.

4 The lumen of a tube can with certainty be kept permanently open by the insertion of catgut through it.

5 The shorter the tube is made the less likely will it be that its lumen arrests the passage of the ovum.

6 A loss of peristalsis will cause arrest of the ovum in the tube and predispose to tubal pregnancy.

7 Chronic or iodized catgut which is employed to keep the tube open is a likely cause of salpingitis with consequent loss of peristalsis.

8 The future cure of female sterility is now largely a question of improved technique for it is based on a definite knowledge



NOTES OF A CASE OF EXTRA-UTERINE PREGNANCY RESULTING AFTER  
RESECTION OF THE TUBE AND INSERTION OF  
CATCUT TO KEEP IT OPEN

B. BETHEI SOLOMONS M.D. F.R.C.P.I. DUBLIN

( ) ec l g f H p t l

WHEN Dr Tweedy informed me that he intended to write a paper on tubal pregnancy following resection of the tube with incision of catgut in the lumen I mentioned to him that I had a similar experience. He suggested that I should read not so much the case which I append.

[illegible]

to be a most rational procedure and I have adopted it in many cases. I believe its main advantage lies in the fact that it preserves the patency of the tube while the resected portions are raw. I do not believe it is necessary that it should be placed so that it traverse the entire length of the tube through the uterine os tum.

It is difficult to understand why extra uterine pregnancy resulted in the case that I have reported. It is generally agreed, as noted by Blacker that the commonest cause of tubal pregnancy is a mechanical interference or a failure of the forces which ordinarily lead to the passage of the ovum into the uterus and that the two factors which predispose to these are (a) a change in the musculature of the tubal wall and (b) a disappearance of the ciliary currents in the tube a result of changes or hedding of the epithelium. Blacker also state definitely that there is no proof that antiperistaltic action of the tube hinders the passage of the ovum to the cavity. But the general summing up of modern opinion as to the etiology of tubal pregnancy is most unsatisfactory—it is generally due to more than one factor.

The incision I cut out in the tube to keep it open after resection seemed to me when I first heard it suggested by Dr Tweedy.

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## INDICATIONS FOR SURGICAL INTERFERENCE IN ULCUS VENTRICULI

## AND UNDERLYING FACTORS INFLUENCING RESULTS OF THE OPERATION

BY M. H. GROSS, M.D. AND I. W. HELD, M.D. NEW YORK

THERE are still differences of opinion as to when a gastric ulcer should be submitted to surgery. Extremists as to both internal and surgical treatment exist. Some internists even go so far as to claim that practically all gastric ulcers belong to the domain of internal medicine whereas some surgeons of repute teach that ulcer of the stomach spells surgery. Neither extreme is justifiable. If the surgical result of ulcer were uniformly and lastingly favorable ulcer of the stomach would be unquestionably a surgical disease. Unfortunately we know this is not the case and therefore before surgical intervention is advised at least definite indications must exist.

In making our indications for operative interference it seems to us best to speak of *relative* and *absolute* indications. To the former belong cases where for one reason or another thorough and efficient medical treatment is impossible such as the great mass of wage earners who because of the demands of their occupations cannot observe either prolonged dietetic regime or the necessary rest and hygiene required for successful treatment of ulcer ventriculi.

It is not very encouraging that economic conditions should be a determining factor for surgical indication. We are certain that if public hospitals and more private sanatoria as well as country resorts—with or without spas—were more attentive to dietetic rules medical treatment would claim ever so many more cures. As it is however at present we must content ourselves with advising the most accessible method.

To the *relative* indications also belong the cases where there are distinct signs of excessive fibrous tissue formation around the ulcer as shown by the niche if on the lesser curvature or in the pyloric region giving rise to progressive pyloric stenosis.

We hold with Boas, Roenheim, Ewald, Kuttner, Sippy, Hamburger and Ingham

that these cases should be treated medically. Failure to yield to prolonged and conscientious medical treatment or tendency to frequent recurrence or progress of the local lesion as determined by means of X ray make surgery imperative.

We realize that in taking this stand we step on ground subject to criticism from authors who consider every niche or induration a precancerous stage and hence a surgical disease. Their contentions have been strengthened by the careful and competent studies of Wilson and MacCarty in the Mayo clinic. Following their publications Cole goes so far as to state that X ray signs of induration on the lesser curvature are to be interpreted as a precancerous state a statement one may consider at least daring.

From the pathological studies of Orth, Achhoff, MacCallum, Ewing and Friedenwald and our own clinical observations we are inclined not to accept such extreme views. Clinical observations certainly favor the more conservative view. It is however a most perplexing problem for the clinician what course to pursue to be of greatest benefit to the patient when pathologists of repute disagree.

As stated above the main support of the claim that cancer often originates on the basis of ulcer is at present at the Mayo clinic supported by the studies of Wilson and MacCarty. These observers with their unlimited opportunities to study the excised ulcer tissue and occasion to see the earliest microscopical change of carcinoma contend that a great number of these specimens show beginning cancer. It is curious that pathologists controlling in immense amount of postmortem material fail to corroborate the findings of Wilson, MacCarty and others. From the clinical standpoint (judging ulcer cases according to their course) the impression is left that the frequency of cancer on the basis of ulcer is not so common.

It seems to us plausible to assume that the reason for the controversy lies in the fact that the school representing the pathological study of autopsy in 1900 (Mayo) report on a different condition from that which bore its deductions on postmortem pathology (Orth, Aschoff, Ling etc).

We feel that the ulcer lesions on the lesser curvature which show microscopic evidence of carcinoma are not cancer on the basis of ulcer but ulcer on the basis of a beginning cancer. Our reasons for this are the following:

1. The fact that a small ulcer becomes the cause of persistent symptoms not influenced by symptomatic treatment is contrary to the result obtained with ulcer of the stomach. This would tend to prove that the basis of the ulcer is such as to interfere with healing. An ulcer on a previously healthy mucous membrane shows a marked tendency to heal. A progressive ulcer must necessarily be implanted on necrotic degenerative tissue as would be the case in cancer.

The X-ray observation of Levy Dorn and Ziegler that a stretched out appearance of my part of the lesser curvature where fluoroscopic and recent angiographic evidence of peristalsis missing is a significant of early carcinoma of the lesser curvature. Independently Cole observed the same phenomenon by the method of serial roentgenography in interpreting it however primarily as a manifestation of indurated ulcer on the lesser curvature.

It is clinically known that small ulcer of the tongue improve very readily, it heals temporarily. If symptom of a small ulcer not detectable to the surgeon's touch persists and necessitate operation may not be that it is an ulcer on a beginning cancer.

In fact Cole in his later publications speaks of the indurated ulcer as a pre cancerous stage and include with the indurated ulcer those where no peristalsis is seen on a given area of the lesser curvature and those where niches formation has resulted. Cole made a valiant effort to diagnose carcinoma of the stomach by X ray as early a stage as is only possible by means of a microscope. Enlightened in

formation undoubtedly resulted from Cole's work. His generalization however that each niche is a sign of a precancerous state has led to just criticism on the part of the recent genologist clinician and pathologist. It is our opinion that an induration on the lesser curvature with absence of peristalsis is to be considered early carcinoma and if ulcer is present it is implanted on the carcinoma. A niche on the other hand is in the vast majority of cases an inflammatory and reparative manifestation of an ulcer.

Quite often clinical manifestation of pyloric stenosis is as well as the effect of a niche are the result of accompanying inflammatory changes which subside in the course of internal treatment. This explains why marked gastric retention simulating complete closure of the pylorus almost entirely disappears in the course of treatment and also explains the X-ray observations of Leo Schuller (abroad of Hamburger in Chicago and Joseph S. Diamond (personal communication)—that a niche may disappear after successful internal treatment. Wilensky (personal communication) from a microscopic study of callous ulcers came to the conclusion that most of these ulcers have started as carcinoma and that the ulcer is implanted on top of a carcinoma. While we are not in a position to furnish absolute evidence in favor of the above conclusion we feel that such views may be of benefit from a clinical standpoint.

If a patient presents symptoms of ulcer of the stomach and there is X ray evidence on the lesser curvature corresponding to the description of Cole with no response to medical treatment we should look upon the condition with great suspicion. More diagnostic efforts such as the Glucuzinski method (diminution of acidity after a Riegel meal) the Wolf Junghaus test etc should be applied in order to arrive at a positive conclusion. When in doubt the patient should be given the benefit of surgical interference. Such cases would really represent early stages of carcinoma and may respond successfully to operation.

As to extensive callous ulcers on the lesser

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curvature with adhesions to the adjacent organs we still adhere to the belief based on the exact microscopical studies of Ewing MacCallum and others that the implantation of carcinoma is the exception. With reference to their yielding to medical treatment we agree with Schuller Hamburger and others that the fear that carcinoma is implanted is not justifiable and that medical treatment may be tried.

There are other cases of ulcer of the stomach where the symptoms are not so much due to ulcer proper but to its consequences we refer to instances where adhesions to the pancreas give rise to intermittent diarrhoea and creatinorrhœic and fatty stools or adhesions of the stomach to the surrounding viscera interfere with the motility of the stomach giving rise to fermentation and distention. Surgical interference in such cases is seldom successful. Prolonged medical treatment is advised and surgery only as an *ultima ratio*.

The absolute indications for surgical interference are

- 1 Cases in which notwithstanding prolonged medical treatment occult blood persists causing a progressive decline in the health of the patient. Such cases must be operated upon without delay for two reasons because as first pointed out by Boas the persistence of occult blood and its most common accompaniment—gradual reduction or even disappearance of free acid—may mean carcinoma also even without carcinoma the secondary anemia prevents the healing of the ulcer and makes medical treatment unsuccessful.

- 2 Cases in which hæmatemesis is repeated notwithstanding appropriate care operation should be performed if possible during the free interval.

- 3 Cases in which the history of one or more attacks of excruciating epigastric pain with collapse manifestations indicate threatened perforations which can now be verified by the X-ray finding of penetrating ulcer.

- 4 Acute gastric perforation. The sooner the operation is performed the greater the chances of recovery.

- 5 Complete pyloric stenosis.

- 6 Organic hour glass contraction.

- 7 Cases in which in addition to the ulcer there is co-existent chronic appendicitis or disease of the bile passages with or without stones.

#### OPERATIONS OBJECT ULTIMATE RESULTS

It is known that surgical operation does not remove the etiological factor of the disease and only in exceptional cases does it do away with the pathological seat. This is the reason why Friedenwald and Baetsjer<sup>1</sup> must be credited with foresight in having united medical and surgical treatment of gastric ulcer. In their article they correctly point out the necessity of prolonged post-operative and appropriate dietetic treatment in order to achieve lasting favorable results.

The uniform dietetic measures however as laid down by these authors cannot in our opinion hold good in every case. We believe as will be shown later that the disturbed gastric function if present after an operation for gastric ulcer results from varied causes and hence the reinstatement of proper function has to be directed according to the underlying causes if demonstrable.

*Gastro-enterostomy.* The operation first performed for ulcer ventriculi if causing pyloric stenosis was anterior gastro-enterostomy. This was later replaced in the majority of cases by posterior gastro-enterostomy.

Numerous experimental and clinical studies related to the favorable effects of gastro-enterostomy have until recently been attributed to the following factors: drainage, regurgitation of intestinal juice—thereby reducing acidity, decrease in total chlorides.<sup>2</sup> It would be utterly impossible to do justice to the literature that has been piled up within the last few years on the subject of gastric surgery in ulcer ventriculi in general and gastro-enterostomy in particular. We shall therefore discuss only such experimental data of physiologists and clinicians as seem to have established permanency in their relation to end results.



These authors have rightly laid their main stress on the kind of operation and its effect on the functions of the stomach. Most of them agree that whatever operation is performed in the course of time the secretions shape size peristalsis and time of emptying return very much to normal. Leo Schuller was the first who confirmed on human beings after gastro enterostomy the work of Cannon that the chymification of the food continues in the pylorus as it would without a gastro enterostomy and that where the food passes the pylorus the new stomach functionates less. According to Schuller and others this fact is a disadvantage and some have therefore advocated larger openings at more dependable points. Others (A. A. Berg) do pyloric exclusion in order to facilitate the passage of the food through the new stoma only. We are of the opinion that the tendency of the pylorus to begin functioning again is an advantage.

Leo Schuller brought out an important point unfortunately not as yet generally recognized that in floric ulcer a postoperative ulcer cure is essential. He also showed that the postoperative results are not always lastingly favorable because atony of the stomach persists.

The latest work on postoperative results is that by Wilensky and Crohn. They studied the secretory and motor phenomena the former by means of the fractional method the latter by X-ray. The tone of the stomach was observed by means of the graphic method of Carlson. They agree with the findings of other authors that after a gastro enterostomy there is regurgitation of intestinal juice into the stomach influencing the acidity they also find that motility is rather moderately hastened or at least normal. In these studies they attempted to trace the occurrence of symptoms after gastro enterostomy to disturbance of the secretory and motor processes.

Of all their findings it seems to us that the most important is the one concerning the tone of the stomach. Independently of Schuller they found that a good tone is an important deciding factor in the lasting favorable results after a gastro enterostomy and their deductions are most convincing.

From the point of view of the internist it seems to us that the results of gastro enterostomy are dependent first on the seat of the ulcer and second the tone of the stomach before the operation.

A pyloric ulcer giving rise to organic stenosis has as is well known two stages the compensatory stage and that of a broken compensation. During both stages the delay in the emptying of the stomach is a pronounced phenomenon and responsible for symptoms. The difference is however that in the compensated state the mechanical gastric digestion is excessive as manifested by the large quantity of secretion and over active peristalsis. Food which cannot be acted upon by gastric secretion is practically liquefied before some of it passes in the form of a thin stream through the narrow pylorus into the intestines. The tendency of such a stomach to empty its contents is manifested by the regurgitation of sour fluid (water brash) or vomiting of great masses of food that could not undergo chymification or liquefaction in the stomach. Evidently the associated pylorospasm prevents the sour chyme from passing the ulcer area. Therefore a new opening (posterior gastro enterostomy) is as it were almost wished for by the stomach. In reality this corresponds to practical results. Ever since gastro enterostomy has been performed for ulcer ventriculi the most favorable results are obtained in benign pyloric stenosis. In perfectly successful cases the food leaves the stomach through the new stoma exclusively shortly after operation by drainage and later in small successive portions accompanied by normal peristalsis. Passage of food through both openings begins when the floric ulcer has come to a standstill so that the resulting pylorospasm no longer exists.

How much of the food will pass the pylorus in the course of time depends upon how much of the stenosis was primarily due to fibrous tissue formation and how much to associated inflammatory changes and pylorospasm. That the food has a tendency to pass through the pylorus notwithstanding the existence of a new opening is evidenced by the fact that even a pyloric exclusion in time is overcome.

In order however to achieve lasting results the dietetic and medicinal regime must be carried out for four to six weeks after the gastroenterostomy as carefully as if no operation had been performed. For at least two years longer prey and irritating food must be avoided.

In case symptom of ulcer ventriculi recur within a short time after the operation notwithstanding the care outlined above the possibility of gastrojejunal ulcer (ulcer at the point of operation) must be borne in mind. This type of ulcer its diagnosis and treatment will be discussed below.

Sometimes symptoms of ulcer with marked hyperacidity and gastric pain occur periodically after a gastroenterostomy. It is most common in individuals who ignore dietetic rules. It would be very erroneous to attribute the symptoms to a closure of the new stoma and advise operation again. It should however be remembered that the hyperacidity often causes spasm of the new opening as first pointed out by Zweig. We believe that this spasm serves a protective purpose so as to prevent the acid chyme reaching the jejunum directly. Proof that this is plausible lies in the fact that a successful cure with the subduence of hyperacidity reinstates the function of the new stoma.

Rational treatment consists in lavage of the stomach with an alkaline solution (sodium bicarbonate solution 1 pint temp 100°) every morning for four to five days. Also frequent feeding with predominating fat diet of a low melting point milk with sweet cream thin cereal with butter yolks of eggs and 1 tablespoon of olive oil (1:1:1). This feeding has proved effective as demonstrated experimentally by Katzenstein. He showed that the acidity after a gastroenterostomy is reduced by the regurgitated intestinal secretion and bile. There are in turn much greater in quantity and more rapidly brought on by a fat rich diet. Katzenstein showed on animal that with a fat poor diet the regurgitation of intestinal secretion occurs after an hour and a half with a fat rich diet within half an hour.

A rarer cause of gastric stagnation after gastroenterostomy may be the loss of the tone of the gastric musculature. This condition is accessible to diagnosis by means of the Nixy Lavage with small quantities (50 cubic centimeters) of an alkaline solution every morning for one week, rest in bed and a semi solid nutritious diet during frequent interval will bring about favorable results.

A still rarer complication in this form of benign stenosis after gastroenterostomy is the so called vicious circle. Persistent regurgitant vomiting after gastroenterostomy containing more or less bile and not controlled by lavage is designated as the vicious circle. Moynihan<sup>3</sup> classifies four varieties of misdirected current any one of which would bring about a vicious circle.

1. Regurgitation of duodenal contents through the pylorus.

2. Escape of fluids from the stomach into the afferent loop.

3. Escape of fluid from the afferent loop into the stomach (the most frequent and grave variety).

4. Regurgitation of the contents of the afferent loop into the stomach.

As to the cause of regurgitant vomiting Shlumsky considers the following:

1. Formation of a spur this is the most frequent and is caused by a sharp kink between the two links at the point of junction.

Jejunal displacement may cause a kink at the duodenojejunal junction causing duodenal obstruction.

2. The mucous membrane of the stomach may form large pouting valves thereby obstructing the afferent opening.

3. Closure of the anastomotic opening on account of an improperly applied stitch.

4. Compression of the afferent loop by the colon (Doyen).

5. Constriction of the afferent loop by an opening in the transverse mesocolon (Stendel and Czerny).

6. Antiperistalsis of the implanted jejunum (Woelfler).

Carmichael and Miller<sup>1</sup> studied a number of regurgitant vomiting cases by X ray after gastroenterostomy. The time that had elapsed since operation ranged from one month to ten years with an average of three years.

It is noteworthy that in some cases of regurgitant vomiting a second surgical exploration failed to reveal an adequate cause especially where a gastroenterostomy was performed to relieve symptoms without a demonstrable lesion of the stomach. In most of the cases they could find no roentgenological evidence to account for the symptoms. In ten cases there were X ray signs of great disturbance due mainly to obstruction as shown by the retention of the six hour meal, large sized stomach, failure of the barium to pass through the stoma and hyperperistalsis.

At reoperation various conditions were found. In three instances adhesions were the cause of obstruction, one showed a stricture produced by contraction of the opening through the gastrocolic omentum and in another case the gastroenterostomy had been made on a long loop which had kinked. If the continuous vomiting is due as shown above to organic obstruction, quick surgical intervention should be resorted to. Deaver attributes all cases of so called vicious circle to mechanical interference and advises operation at once.

#### BENIGN PYLORIC STENOSIS WITH ATONY

Cases of benign pyloric stenosis due to ulcer accompanied by a high degree of atony of the stomach after gastroenterostomy do not show as high a percentage of favorable results as pyloric stenosis with good tone of the stomach. This corresponds well with the observations made by Carter.<sup>2</sup>

It has already been mentioned that the work of Leo Schuller and that of Wilensky and Crohn point to the fact that a diminished or lost tone of the gastric musculature is often responsible for failure to get satisfactory results after a gastroenterostomy. Our own clinical observations are fully in accord with the studies of these authors.

The causes of postoperative disturbances are manifold. Shortly after the operation the so called vicious circle is much more common in the atonic stenosed stomach. In other cases the immediate postoperative results are favorable only when the patient begins to partake of a more or less liberal diet does recurrence of symptoms set in. These are mainly due to stagnation, hypersecretion, hyperacidity and food residues. The X ray reveals a large sized atonic stomach where but very little food forces itself through the new stoma during protracted intervals. This indicates that the function of the new stoma is interfered with by spasm. Such findings are often interpreted as being due to a technical fault of the surgeon and operation is advised. Frequent negative surgical findings in such cases ought to teach us that the cause of the delay in the emptying may be the spasm of the stoma due to hyperacidity.

If upon recurrence of symptoms the patient again undergoes an ulcer cure initiated by a few gastric lavages and the diet for an indefinite length of time is of a well prepared nourishing non irritable nature, complete comfort will result. If the symptoms are ignored and dietetic errors indifferently committed the acid chyme reaching the jejunum may lead to a jejunal ulcer.

In other cases the lack of satisfactory results after a gastroenterostomy in an atonic stomach may be due to the fact that the stomach has become a persistent drainage tube. In such a stomach gastric secretions gradually diminish and finally even disappear because the stimulus of the food is missing when the stomach serves only as a passageway.

Another factor tending to reduce acidity in these cases is the regurgitation of excessive intestinal juice into the stomach. This is because the food crowding the jejunum overstimulates its secretions and at the same time increases the tone of that part of the bowel. Thus we see again that drainage and regurgitation of intestinal juice into the stomach so beneficial shortly after gastroenterostomy become sources of discomfort when persistent. The symptoms due to irritation of the small intestine consists in abdominal cramp, distention, sensation of



fullness, nausea and vomiting and often there is also a secondary colitis. Notwithstanding that the food is seen to leave the stomach in a continuous stream marked delay in emptying is encountered. This is because the overcrowded small intestine prevents the emptying of the stomach mechanically and by reflex. In these cases the stomach always contains large quantities of intestinal juice and bile especially an hour or two after meal. This may be explained by the physiological observations of Alvarez<sup>1</sup> that the higher tone in the small intestine causes regurgitation of its contents into the viscus of diminished tone, namely the stomach.

In order to achieve favorable results it is of the utmost importance to treat these postoperative cases appropriately. Here the guiding therapeutic principles are the lost tone of the stomach and its perverted secretion. Because of the diminished tone the food should be given in such form as not to necessitate gastric chymification and digestion. Better for that purpose are fats at a low melting point (cream, butter, yolk of egg) and finely prepared carbohydrate in the form of cereal and toast. When the patient tolerates the soft stuff, well proteins may be introduced in the form of egg white, cream, cheese and the vegetable proteins (beans, peas, pinach in puree form). Later meat, scraped or chopped and cooked fruit are added to the diet.

It must be emphatically stated that while the food given should be of a quality substantial enough to cause an increase in the general tone of the body, quantity and time of feeding must always be so individualized and guarded as not to overburden the stomach. By such method the tone of the stomach may gradually be reestablished and regurgitation of intestinal juice prevented thereby avoiding pathological neutralization of the gastric secretions.

Great caution is to be exercised when even the slightest symptoms recur. The cause should at once be determined and if the loss of tone and regurgitation of the intestinal juice prove to be the source, treatment as

outlined above should be instituted. In some cases regurgitation can only be controlled by gastric lavage at beginning of treatment.

As to whether a pyloric exclusion in addition to the gastroenterostomy in cases of pyloric ulcer is the preferable procedure, opinions differ. Some surgeons, especially A. A. Berg, hold that the exclusion is almost essential to a lasting favorable outcome. Others, headed by Kocher, are of the opinion that not only is an exclusion harmful but it is a drawback because it interferes with the regurgitation of duodenal contents. Another objection to pyloric exclusion arose when the X-ray demonstrated that notwithstanding the pyloric exclusion patency is reestablished in the course of time, a finding confirming Cannon's experimental work on animal. From a physiological standpoint it seems to us that nature's effort to heal the ulcer keeps the pylorus closed until the ulcer is healed and until then the new stoma serves as the sole exit for the food without as well as with pyloric exclusion.

We believe, however, that we are justified in suggesting the following: cases of pyloric stenosis if the stomach is in a compensatory state are the ones to be benefited by a pyloric exclusion. While it is true that pylorospasm is nature's pyloric exclusion, it may be reasonably assumed that the pathological hypercontractility of the compensated stomach of benign stenosis may still be a factor for some time after a gastroenterostomy in forcing acid chyme through the pylorus and prevent healing of the ulcer. Pyloric exclusion obviates such a possibility until the ulcer heals. The good tone of the stomach eventually overcomes the exclusion and the passage of food through the old opening is made possible. In the atonic stomach on the other hand, pyloric exclusion ought to be unnecessary and for beneficial effects may be even a disadvantage because the weakened tone of the stomach may never be so restored as to overcome the exclusion and drainage may be a persistent factor. H. S. Carter actually reaches the same conclusion so far as pyloric exclusion in an atonic stomach (the seat of benign stenosis) is concerned.

The resection of pyloric ulcer has been advocated by many surgeons especially by Hübner who is unusually radical. The record of higher mortality however has led such able surgeons as Deaver, Berg, the Mayos, Erdmann, Peck, Finney and others to advocate a more conservative procedure.

Unless one is absolutely convinced that it is not a benign disease gastro enterostomy is the preferable operation.

The method of surgical procedure in ulcer on the lesser curvature is quite varied. This is the location where excision, sleeve resection, cauterization with or without gastro enterostomy, gastro enterostomy or gastro duodenostomy alone have been advocated. Each method has its ardent adherents.

The late Rodman, who years ago advised resection because of the possibility of the ulcer becoming cancerous, had an immense following particularly in our country and England. Bulfour<sup>1</sup> in his latest praiseworthy work reporting on 677 cases arrives at the conclusion that cautery combined with gastro enterostomy is the ideal procedure.

As internists we would err even by attempting to suggest preference for any one method. It is the skilled surgeon who out of his wide experience must decide what operative procedure is the best. One fact however is well established that recurrence of symptoms after a gastro enterostomy for ulcer on the lesser curvature is rather the rule than the exception.

It is essential to determine the cause of recurrence in some cases when in others the operation is effective. In order to make clear our reasoning as to why the operative results are not uniform it is necessary to review briefly our X-ray observation as to the mode of activity of the stomach with a florid ulcer on the lesser curvature especially when the organ is of good tone.

In this case the stomach when filled with contrast substance is usually hypertonic much shorter than normal. The fornix (fundus) part is much wider than the tube and sinus. Pylorus portion, pylorus and cardia are nearer each other in extreme cases forming the Schmieden tobacco pouch stomach.

In addition to the hypertonicity hyperperistalsis especially in the region of tube and sinus is very marked. During the florid state of ulcer in a great number of cases there is a deep persistent contraction on the greater curvature opposite the seat of the ulcer. The pyloric function in the early part of digestion—first and second hour—is normal or allows the food to pass at times more rapidly than normal. Later after two or three hours the hypertonicity and hyperperistalsis in tube and sinus are diminished while the pylorus shows considerable spasm.

What are the factors which create these phenomena? It seems to us that the following explanation is applicable: the hyperperistalsis and hypertonicity early in digestion go hand in hand with the existing hypersecretion. Chymification therefore is hastened and the food made ready to pass the pylorus very quickly. The pylorus opens up readily because of the acid influence on the duodenal secretions and the absence of the lesion in the pylorus proper. Later in the course of digestion the hyperactivity of the stomach subsides because the musculature tires.

During the period of the hyperactivity of the gastric musculature food still in need of chymification is present, secretions even excessive but the peristaltic action essential for complete chymification in order that the food may be ready to pass the pylorus is missing. Hyperacid and coarser particles of food bring about spasm of the pylorus. The persistent contraction opposite the ulcer which indicates the protective feature of the ulcerated area likewise disappears with relaxation of the muscular tone. Pylorospasm plus the exposure of the ulcerated area to the chyme and gastric secretions bring about the pain. Gastro enterostomy in these cases furthers a more rapid evacuation of the contents. During the period of hypertonicity and hyperperistalsis chymified and well prepared food is transmitted through both the old and new opening so that after two and a half or three hours very little food is left to bring about an excess of free acid. In addition the regurgitating intestinal juice through the new stoma and some duodenal

juice entering through the pylorus tend further to neutralize the gastric secretions thereby preventing further irritation of the ulcer and favoring its healing.

It is well understood that for months after the operation (and in vagotomies with tendency to hyperacidity even indefinitely) care must be exercised as to quality, quantity and time of eating. The mental state of the patient must be so controlled as to prevent excessive acid secretions thereby avoiding recurrence of the old ulcer or formation of a new one.

In ulcer on the lesser curvature in hypotonic and atonic stomach the gastro enterostomy is only too often a failure. To facilitate explanation a brief discussion as to secretions and motility before operation is not superfluous.

The acid secretions are usually increased. The X ray appearance of the stomach in the course of filling reveals a degree of almost hypertonicity, namely active peristalsis and marked indentation on the greater curvature opposite the ulcer. This state however due to the weak musculature readily gives way and relaxation and atony set in. So transient is the stage of hypertonicity that unless the filling of the stomach is watched fluoroscopically it escapes observation.

With hypersecretion and loss of tone the predominating factors marked six hour residue is present notwithstanding the fact that the pylorus is not the seat of the disease. Favorable results of a gastro enterostomy depend on the more rapid emptying of the contents through both openings—which in itself is a factor in diminishing acid secretions and in addition the intestinal juice further neutralizes the acidity thereby conducing to healing of the ulcer.

Unfortunately various complications are apt to arise, not the least infrequent of which is the persistence of the ulcer symptom, pyrosis, vomiting, pain, regurgitation of sour fluid, etc. These are the consequence of hypersecretion and spasm of both openings and in many cases may be overcome by prolonged ulcer treatment.

It seems to us worthy of suggestion that in cases of that nature the gastro enterostomy

should where practicable be preceded by internal treatment directed against the hyperacidity and weakened tone of the stomach. Small gastric lavages with 5 per cent bicarbonate solution every morning for one week, alkalies by mouth according to the method of Bourget or Sippy, belladonna in the form of suppository and milk and cream diet in quantities not exceeding 6 to 8 ounces every two hours.

A postoperative complication most common in these ulcer (as yet unaccounted for) is persistent vomiting, sometimes leading to a fatal termination. Given the clinical facts that the deeper the ulcer on the lesser curvature the more the tendency to disturbed tone and vomiting, also the observations of surgeon (A. A. Berg personal communication) that resection of the ulcerated lesser curvature lead to uncontrollable and fatal vomiting—it seems plausible to assume that the interrupted conductivity of innervation on the lesser curvature disturbs the current of normal peristalsis and leads to retroperistalsis.

In the course of our work we read with interest the results of the experiments of W. H. Barber who found that the removal of a saddle shaped section from the lesser curvature disturbs the emptying power of the stomach. This he attributes to disturbance in the relationship of the neuromuscular structure, not to mechanical operative interference.

Surgeon of experience in addition to excision or cauterization (Balfour) and gastro enterostomy perform a jejunostomy through which the patient is fed until normal activity of the stomach is reestablished.

Other complications and sequelae like gastrojejunal ulcer and postoperative adhesion may occur here as after a gastro enterostomy for pyloric ulcer.

Gastrojejunal ulcer is not an infrequent sequel of a gastro enterostomy. It was first described by H. G. Peter on and later more completely by W. J. Mayo.

The most complete contribution on the X ray diagnosis of gastrojejunal ulcer was

A. Surg. Phil. 7 Dec. 5  
An. S. Phil. 900 p. 36  
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furnished by Carman and Balfour<sup>1</sup> Carman and Miller Peterson and W J Mayo found most of the gastrojejunal ulcers to be the result of a non absorbed suture material They found however that the ulcer was present even when the Murphy button was used

Clinically the symptoms of the original ulcer may recur and absolute diagnosis by symptoms alone is impossible

According to Carman and Miller who studied roentgenologically 14 cases of gastro jejunal ulcers the following roentgen ray manifestation should be sought in order to establish a diagnosis

1 Deformity of the stomach which can be made visible by lifting up the overhanging lower border by manual pressure and exposing the anastomosis if it is on the horizontal part or examine in the oblique position if anastomosis is on the vertical part

2 The dimpling at point of anastomosis is exaggerated and irregular If gastrojejunal ulcer develops after an anterior gastro enterostomy the ulcerated area may be so thickened as to give rise to a palpable mass

3 Narrowing and deformity of the afferent loop of the jejunum

4 Patency of stomach not free as evidenced by the narrow stream of the contrast substance and marked six hour residue

5 Exaggerated peristalsis of the stomach

6 Lessened mobility of the stomach if adhesions are present

7 Spasticity of the stomach due to reflex irritation

8 Dilatation of the duodenum

Not all signs must be present The most significant are the deformity and irregularity of the afferent loop narrowing of the stomach and the exaggerated dimpling and sometimes the formation of a pouch at the stomach

Where the patient is in a condition to stand a prolonged operation for ulcer on the lesser curvature very good results are obtained by sleeve resection As demonstrated by experimental work and the experience of numerous surgeons and clinicians shortly after resection the stomach is somewhat smaller but in the course of time full accommodation sets in

Complications may occur after a gastro enterostomy where the ulcer was not excised such as a hemorrhage or perforation further more the formation of a new ulcer may be the cause of recurrence of symptoms

Chronic appendicitis if overlooked at the time of operation may continue to give rise to gastric disturbances simulating ulcer This is especially true of an appendix which is small and from external appearances looks normal but the mucosa is atrophied Diseased gall bladder not infrequently concomitant with ulcer does give rise to postoperative gastric symptoms Sometimes long after gastro enterostomy the unhealed ulcer perforates slowly causing local peritonitis which in turn may form a large exudate manifested by a palpable mass or this mass may suppurate leading to abscess (Wilensky)

Hernia in the abdominal scar giving rise to the persistence of ulcer symptoms has been mentioned by Morrison

Where anaemia is a marked factor for a prolonged period after operation and where infection can be localized Wilensky rightfully points out that the postoperative ulcer symptoms may be overcome by treating the underlying causes

Operative procedure for hour glass contraction extensive adhesions deeply penetrating into neighboring organs is entirely of surgical interest The method of operation depends altogether upon the judgment of the surgeon

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Fig. 1



Fig. 2



Fig. 3

Fig. 1 Case 1. Unhyseal fracture. The apparent shortening of the neck and the loss of the prominence of the trochanter are explained by the outward rotation of the limb.

Fig. 2 Case 1. Taken through the plaster spica after

reduction. The neck fragment is now within the acetabulum; the trochanter is apposed to the side of the pelvis and symmetry is restored.

Fig. 3 Case 1. Six months later showing anatomical cure. Compare with Fig. 1.

clearly that conventional treatment was utterly inadequate both in means and purpose to assure the primary essentials of success and that distortion and shortening of the limb, limitation of motion and discomfort, the characteristic results in childhood as in adult age, were the direct consequences of inefficiency and neglect.

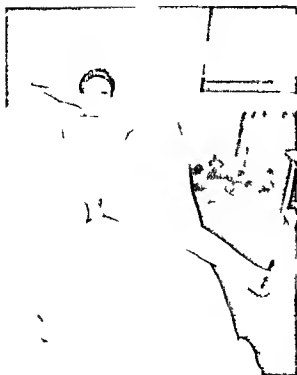
This positive illustration of cause and effect led to the evolution of the abduction treatment which had the great advantage that it was first applied in a class of cases in which mechanical efficiency was the only consideration. When therefore this efficiency had been demonstrated and its effects confirmed by the final results it only remained to test the new method under less favorable conditions.

This test has long since proved that it has a wider range of practicability than conventional methods which are generally supposed to be better adapted to age and in firmity and that the results are more directly determined by the quality of the treatment than in any other injury of its class.

The statement that conventional treatment is inadequate to assure the primary essentials of success may be easily verified

by technical analysis of the methods in common use the basis of all being traction on the limb. Occasionally it is applied in the combined form of Maxwell or made more direct by the insertion of nails or ice tongs in the femur but usually by adhesive plaster supplemented by a side splint. The so called extension must be light if the fracture is supposed to be impacted sufficient to relieve pain in hopeless cases and if the fracture is complete it is applied ostensibly for the purpose of reducing displacements and fixing the fragments during the period of repair.

Traction in whatever form is inadequate because the mechanical problem at the hip joint is quite different from that in other situations. If the fracture is for example of the shaft of the femur a sufficient pull upon the limb should reduce the overriding while the tension on the ensheathing muscles should align the fragments and thus assure the resistance of end to end apposition. The neck of the femur projects at an angle and the fragment lies in a lateral relation so that the resistance of mutual pressure which is absolutely essential to repair in fractures of the small part of the neck cannot be assured by this means. Even if lateral apposition



tional recovery is also the first essential of repair.

In fracture of the neck of the femur the head being fixed in the acetabulum the displacement is always of the outer or limb fragment. If the separation is complete the displacement is usually upward, backward and outward and to appose the fragments the limb must be lifted forward, rotated inward and drawn downward to its normal length. But since the neck of the femur projects from the shaft at an angle the apposition is in a lateral relation and is unstable because there is no point of resistance. If now the limb be abducted to the normal limit the extremity of the neck is brought down to a horizontal plane. As the capsule surrounds each fragment its tension consequent on abduction aligns them and since the head is fixed by the acetabulum forces an end to end and resistant contact. Furthermore at the limit of abduction the upper border of the shaft fragment and the trochanter are apposed to the rim of the acetabulum and the side of the pelvis. Thus security is assured by the tense capsule by direct and indirect bony contact and by the muscular impotence incidental to the attitude of complete abduction.

The so-called impactions or incomplete fractures are almost always accompanied by deformity, the neck of the femur being forced downward and backward on the shaft so that its relation to the pelvis is such as it would be if the limb were adducted and rotated inward. In other words the neck of the femur is in contact with the upper border of the acetabulum while the shaft is in line with the body. This contact fixes the inner fragment so that by traction inward rotation and abduction of the shaft the normal relation may be restored.

It may be noted that the characteristic deformity of fracture of the neck of the femur of all types is loss of its upward inclination. It is upon the normal angle that the range of abduction is dependent, the retraction of which entails insecurity of support and a compensatory distortion of the pelvis that exaggerates the disability supposed to be inevitable after this injury (Fig. 10).

is attained it can be maintained in the absence of bony resistance only by constant tension. Thus at best union in this limited case traction is unreliable since it is not under single control.

The purpose of treatment of neck injury is determined by the main command and the accepted rule of practice in adaptation to this inadequacy and unreliability are summarized in the following quotation from a leading treatise on fracture:

The ideal object of treatment restoration of form and function is rarely to be attempted or even sought.

The first indication is to avert the second to get union the third to correct or diminish displacement.

The abduction method is by contrast mechanically adequate to apply surgical principle. Consequently the sequence of the conventional indication is reversed because the correction or diminution of displacement the prerequisite of union.

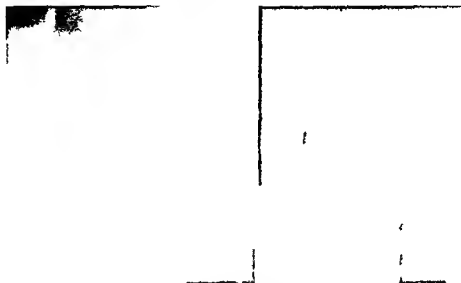


Fig 5(at left) Complete fracture of the neck near the base  
 Fig 6 Taken after removal of the plaster cast showing the process of repair and the restoration of the normal angle of the neck as within the range of abduction

The traditional impaction is a firm implantation of one fragment in another or other resistant relation that assures contact and thus repair. This is however merely a clinical conception suggested either because the deformity is slight or because some voluntary control of the limb is retained which is rarely confirmed by X-ray examination or by the test of reduction. Deformity to a degree to embarrass function should always be corrected even if resistant because the manner by which this is accomplished has no analogy to the breaking up of an impaction and because the more accurate adjustment of the fractured surfaces assured by correction far from endangering union is in many instances the only means of assuring it.

When this adjustment has been accomplished a long plaster spica is applied fixing the limb in full extension full abduction and slight inward rotation. Although the spica is a direct support its chief function is to hold the limb in the selected attitude that makes the internal or anatomical splinting effective as may be demonstrated by X-ray examination through the plaster at intervals of weeks or months.

From this comparative analysis it should appear that the abduction method is adequate because it utilizes the construction of the

joint and its mechanical environment to reduce deformity and to fix the fragments in apposition.

That routine methods are inadequate because they are not adapted to the conditions presented by the situation and character of the injury and since purpose is of necessity dependent upon the means of its accomplishment surgical principles have been modified or disregarded in accommodation to this initial deficiency.

The question at issue therefore is one of mechanics and in order to present this clearly and to follow as it were the line of least resistance in the argument youthful subjects have been chosen for demonstration. For if opportunity is essential to success in cases of the most favorable class it must be doubly so if for any cause the capacity for repair is lessened.

In one particular conventional practice is thoroughly efficient namely in explanations for anticipated failure of which the first is physical weakness which may prevent or modify local treatment. These illustrative cases will serve by contrast to call attention to an important class of fractures as yet unrecognized in the textbooks and to emphasize the fact that the neck of the femur is mechanically a weak point in the skeleton. It becomes relatively more vulner-







Fig. 9. Shows the range of normal abduction and its limitation by bony contact on one side and the deformity of the neck and limitation of the abduction consequent upon uncorrected deformity on the other.

ment of the outer fragment to which the force of gravity predisposes. Slight flexion at the knee reduces the strain on the joint and the inward rotation follows the principle of overcorrection of the pre-existing deformity. When the plaster is firm the patient is placed in bed, the head of which has been raised a foot or more by blocks. This inclination compensates for the pillow and in contrast with the elevation of the foot of the bed as is usual when traction is employed improves the blood supply of the injured part.

If the plaster spica has been properly applied and adjusted it is far more comfortable than any appliance that like traction requires rest upon the back. The patient may be turned at intervals to the side or completely over to relieve the pressure or even moved from place to place without discomfort. Thus hypostatic congestion and bed sores may be prevented.

Various modifications of the support are sometimes used by other surgeons. For example the other thigh is included in the

plaster. This adds to the security of the fixation if the adjustment is not accurate but has the disadvantage of restraining the sound limb. The spica is applied in flexion at the hip and knee with the aim of permitting the sitting posture. This may be an advantage in the treatment of the aged but the adjustment of the fracture cannot be as accurately determined while the flexed attitude might induce resistant contractions. Both limbs are fixed in slight flexion and abduction by a short spica extending only from the umbilicus to the knees. The flexed attitude increases the pressure on the sacrum while the bilateral abduction makes it difficult to turn the patient to the ventral position. Rotation of the limb is not so well controlled and there is the further danger of adduction of the leg. Long spicas are also applied extending above only to the umbilicus. These are far less effective supports and are usually less comfortable than those in which the leverage above and below the joint is more nearly equal.



that produced them on the theory that the outcome is determined primarily by the situation of the fracture or by the relation of the fragments to one another or by deficient nutrition or by other factor over which the surgeon has no control and that conventional practice is a clinical adaptation to exceptional conditions. Consequently that efficiency as it is understood in the treatment of other fractures even if it were practicable is undesirable since it might jeopardize the result. This is an argument in a vicious circle from which there is no escape if one accepts the premises on which it is based. If on the other hand one discards inadequate treatment one of necessity rejects all the conclusions that support it.

The practical point then is whether efficiency and all that it implies is worth while in other words whether opportunity that can only be assured by adequate treatment will favor repair or whether the result is actually determined by chance.

#### SUMMARY

The arguments in favor of surgical efficiency may be summarized as follows:

1 That non union occurs in childhood under the same conditions as in adult life although there can be no question of the capacity of the tissues for repair.

2 That repair after non union is the rule when at open operation the fragments are freshened and adjusted indicating that fixation in apposition is the first essential of success.

3 That experience in bone grafting proves that union is possible under far less favorable conditions as regards the blood supply than in fracture of the neck of the femur.

4 That the obstacles to repair whether intrinsic or extrinsic actual or fanciful that

have thus far justified inadequacy and neglect furnish the strongest presumptive evidence in favor of opportunity as the determining factor in the result.

5 That it has already been abundantly proved by practical experience that repair is possible in every variety of fracture of the hip and at any age and although it can not be asserted that opportunity will always assure success it is self evident that want of opportunity assure failure. Consequently the responsibility for opportunity upon which the result is primarily dependent rests upon the one who selects and applies the treatment.

This conclusion however revolutionary is contrasted with conventional teaching is in effect simply that surgical principles whose application has been made practicable by the abduction method should now govern the treatment of this as of other fractures.

The abduction treatment as the exponent of these principles has made steady progress in recent years. To quote from the *Nouveau Traite de Chirurgie*:

*Cette methode preconisee par Whitman est a l'heure actuelle partout appliquee.*

This encourages the belief that when the treatment is properly presented in the textbooks it will be generally adopted because the method is efficient the purpose definite the effects demonstrable and the patient under single control.

In other words because it meets in a comprehensive sense the conditions essential to success is contrasted with conventional practice which is lacking in each of these particulars and which has been so thoroughly discredited by results as to furnish a legitimate excuse for the virtual neglect which has thus far been the portion of these unfortunate patients.

## FRACTURES OF THE LOWER END OF THE RADIUS

B JOHN R HAPCEI S B M D C AGO  
A P f s C III

THE subject of fractures is as old as the humankind and I will make no attempt to advance anything new. But it is my desire to stimulate renewed interest in this very large and extremely important branch of surgery and by calling your attention to the following facts to remind you that the treatment of fractured bones has not as yet become a perfected science.

The surgeon who makes it a part of his practice to treat fractures is confronted by these facts with increased frequency that to treat fracture according to modern surgical principles necessitate the aid of competent roentgenologist a very thorough knowledge of human anatomy a considerable amount of mechanical ability a definite understanding of the pathological changes that may take place during the process of repair of the bone expert operative technique a wide experience and good surgical judgment.

Like the term rheumatism the term Colles fracture covers a multitude of conditions and as the term rheumatism is applied to many forms of arthritis so also is the term Colles fracture used to describe many types of fracture of the lower end of the radius as well as at times including location in the lower end of the ulna.

Hamilton in 1860 in his treatise on Fractures and Dislocations used the term so-called Colles fractures intimating that then as well as now the term conveyed an indefinite idea and his use of the phrase

the peculiar character of the displacement which characterize the Colles fracture would indicate that the fractures without displacement and those with a different type of displacement were not then classed as Colles fracture while today the term is so loosely applied that most fracture about the lower forearm region are spoken of as Colles. That a Colles fracture is a rather definite location and due to quite a definite mechanical force is well understood but this fact is too

often lost sight of in the descriptions of the various fractures involving the lower end of the radius. Observation has taught us that there are many injuries in this region that are not of Colles type and cannot be treated as such. While there are a great many discrepancies in the descriptions of this type of fracture which Colles described about one hundred years ago yet the consensus of opinion gave Colles the credit for having described the most common type of these fractures. It is characterized by the so-called dinner fork deformity with the line of fractures within three fourths of an inch of the lower articular surface of the radius and extending obliquely downward and forward thus permitting the lower fragment to be displaced upward and backward. This causes the articular surface of the radius to look slightly dorsalward and more toward the thumb and the styloid process of the radius to be raised to the level of the ulnar styloid or even a little higher and giving the hand a position of slight radial adduction thereby producing a distinct prominence of the lower end of the ulna. It seems quite evident that many of the less severe fractures of the lower end of the radius were not recognized as fracture and thus not considered by Colles and perhaps this was better for the patients for as I will endeavor to show later some of the fractures offer a better prognosis by no treatment at all than would be the case if they were recognized by the X-ray and as so often happens were over-treated. However many of the serious lesions are not X-rayed and are thus too often mistaken for minor injuries and are not properly treated. The late John B. Murphy stated at the meeting of the American Medical Association in 1911 that 85 to 90 per cent of Colles fractures resulted badly as they were then treated. This percentage it would seem is a little high and it is quite likely that Murphy's statement was based

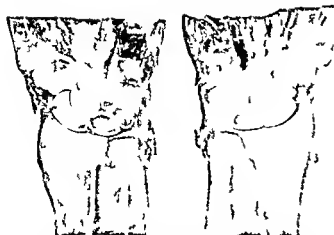


Fig. 1 and 2. Longitudinal section of the joint showing the relations of the carpal to the radius and ulna. Note that the force of violence may be transmitted to the ulna as well as to the radius and the callus may be deposited about the articular surface following fracture.

upon his personal experience with referred cases which to a large extent were probably those that had been carelessly treated by the general practitioner before they found their way into his clinic.

Every surgeon who has treated this type of injury often or has seen a large number of cases will doubtless recall some that have resulted badly and others that should have yielded better results and can recall cases treated by other men in which the results were far from ideal. Who of us will not agree that we should turn our attention for a time to the treatment of these common and serious lesions and thereby establish some better methods or institute a campaign of education that will enable the average physician and general practitioner to better use our present methods?

#### ETIOLOGY

The fractures involving the lower inch of the radius are largely limited to middle and advanced life and a very large percentage occur after middle life.

Very few fractures in this region are found in individuals under twenty and when such an injury does occur it is prone to involve the epiphyseal line. It is the youngest that falls most frequently upon the outstretched hand and yet suffers so rarely from any bone lesion and when the violence is sufficiently severe to produce a bone lesion it may involve the

Extensor tendons  
Radio-ulnar articulation



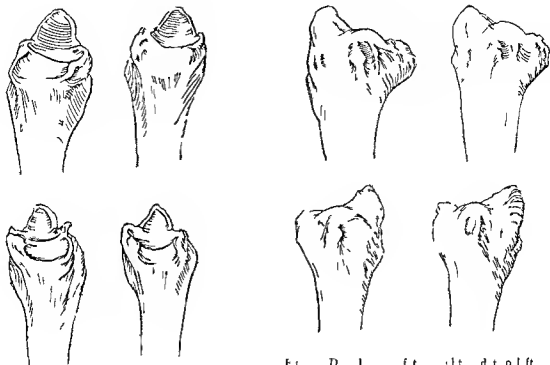
Flexor tendons

Fig. 3. (1) Note the extent of the radio-ulnar articulation which is frequently involved in the fracture and will be filled with callus if precautions are not taken to prevent it. (2) note the close proximity of the extensor tendons on the dorsal and internal lateral surfaces which will be included in the adhesion about the fracture when it is immobilized. (3) too long a time and (4) note further the numerous flexor tendons that may be included in the immobilization reaction of the more severe cases and lead to a lesion if there is an extension of the fingers are not insisted upon after the first two or three days.

epiphyseal line but more commonly the lower third of the radius with or without the ulna or rarely results in some type of fracture about the elbow (Figures 6 to 1 illustrate the types of fractures that may occur in early childhood as a result of a fall on the outstretched hand). The type of violence that produces the more common fractures of the lower end of the radius is too well known to deserve comment at this time but why apparently similar types of violence produce such widely different varieties of fractures—see illustrations—is a question that invites considerable thought and is a phase that should not be considered lightly when treatment is being carried out.

#### ANATOMY

A study of the anatomy of the wrist joint (Figs. 1 to 5) will show how easily the violence is transmitted to the lower end of the radius when the patient falls on his hand it will further show that the violence is transmitted to the ulna by two avenues of contact namely through the radio-ulnar articulation and through the fibro-articular cartilage between the ulna and the semilunar. It is



l a gical to suppose that the radius fracture primarily in the injury and then if the force of the violence is sufficient the ulna will yield. A study of the ectasis will show that there exists a difference in the arrangement of the bones of the wrist and their relation to the radius and ulna which doubtless is important in a measure for the variation in the line of fracture.

A study of the roentgen section of the forearm at the level of the radio-ulnar articulation will show how intimate is the association of various tendons and how they are brought into immediate contact with the fractured radius at the level on both ventral and dorsal surfaces. This fact should be uppermost in the mind of the operator when treating one of the elbow fracture.

of the various changes that take place in the bone as a result of the injury and during the process of repair while the ultimate outcome of a great many fractures depend far more on the pathological changes that occur in the soft parts not so much those that occur at the time of injury but those that are prone to occur during the repair of bone.

#### PATHOLOGY

In the discussion of fractures the term pathology seemingly conveys only the picture

of the various changes that take place in the bone as a result of the injury and during the process of repair while the ultimate outcome of a great many fractures depend far more on the pathological changes that occur in the soft parts not so much those that occur at the time of injury but those that are prone to occur during the repair of bone.

That every fracture of bone is complicated by injury of the surrounding soft parts is a fact that needs no comment but in some fractures considerable changes are thus produced and inflammation the severity of which is in direct proportion to the extent of the primary injury to the soft parts or is may be aggravated by the treatment used.

When a fracture occurs at the lower end of the radius or in any of the bones which make up the wrist joint there is rarely any extensive primary injury to the surrounding soft parts yet the structures are so numerous and lie in such close proximity to the injured bone that soon after the bone lesion occurs

of the various changes that take place in the bone as a result of the injury and during the process of repair while the ultimate outcome of a great many fractures depend far more on the pathological changes that occur in the soft parts not so much those that occur at the time of injury but those that are prone to occur during the repair of bone.



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10

Figs 6 and 7. T. I. age 6 on Sept mb 0 14 fell on the outstretched hand. S. n. i. fracture. re. ery e. dent. After reduction a circular a. l. as a. l. l. and after four weeks union seemed firm. Note that the radius fracture was incomplete and there was no displacement. Note too that ulna was allowed to unite without reduction.

Figs 8 and 9. Same case as 6 and 7. r. t. u. u. December 3 1914 less than three days from time after the first injury with a similar history and injury. Note

the radius fractured at the same level while the ulna remained united. Note the ulna united firmly with the fragments displaced.

Fig. 10. Same case as 6 8 9 no. 12 returned to u. on October 30 1917 for other troubles. Note the complete restoration of the ulna with its medullary canal with no evidence of the old fractures. Note however the same shortening of the ulna in Figures 9 and 10 which is not manifest clinically nor does it disturb the function of the arm in any way.

extravasation of blood and infiltration of leucocytes involve to a greater or less extent the delicate membranes lining the numerous tendon sheaths and synovial cavities which become roughened and lose temporarily that smoothness which permits the free transmission of tendons and articular surfaces. As the inflammation progresses more or less effusion takes place into the structures and during the process of repair if conditions are not favorable how easily adhesions may form between the tendons and their sheaths or connective tissue infiltration take place about the various joints which may also involve the tendons and which will interfere very markedly with the free movements of the many structures that are so essential to the normal function of this important joint. It is just these pathological changes that are responsible for a large percentage of the poor functional results in these fractures. When such changes have taken place we have pathological conditions far more difficult to treat than the original fracture.

The line of fracture in the lower end of the radius ranges very widely as will be seen by a study of the illustrations. When it is recalled that a large percentage of these

fractures occur within an inch of the lower articular surface of the radius it will be seen that a great many times the line of fracture will enter the radio ulnar articulation. A few will enter the wrist joint and in either case callus may be deposited over and about these surfaces if precaution is not taken to prevent it. Displacements of the fragments vary as widely as does the line of fracture. In no small proportion of these cases there is no appreciable displacement even though the line of fracture may be complete and extend in almost any direction. On the other hand the displacement may be so marked as to produce a very distinct change in the position of the hand and wrist as well as the lower articular surface of the radius which in the large percentage of cases is made to look backward and downward. Two fragments is the rule but there may be three or more and the smaller fragments be displaced in any direction. It is these latter cases that are apt to be followed by pathological changes in the soft tissues.

#### VARIETIES

I have made no attempt to classify these fractures. Roberts and Kelly have given a very comprehensive and yet confusing classification.



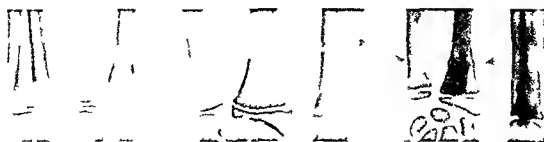


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 1. Lateral view of the wrist joint showing the radius and ulna. Fig. 2. Anteroposterior view of the wrist joint showing the radius and ulna. Fig. 3. Lateral view of the wrist joint showing the radius and ulna. Fig. 4. Anteroposterior view of the wrist joint showing the radius and ulna. Fig. 5. Lateral view of the wrist joint showing the radius and ulna. Fig. 6. Anteroposterior view of the wrist joint showing the radius and ulna.

height in which they describe fourteen varieties with fifteen subvarieties or twenty-nine different types of fracture of the lower end of the radius.

#### DIAGNOSIS

In Figures 1 to 6 note that there is a variation in the position of the lower articular surface of the radius that the radio-ulnar articular surfaces are much larger in some cases than others and may be easily involved in the fractures that trauma of the carpal bone may be readily transmitted to the ulna by means of the fibro-articular cartilage that intervenes that there is not a fixed ratio between the level of the two styloid processes.

A study of hundreds of wrist joints in the dissecting rooms shows a very wide difference in the articular surfaces of the lower end of the radius and ulna. In a few cases the ulna has little or no connection with the wrist joint while in most specimens it has a distinct articular surface. The bony prominence of the ventral and dorsal surfaces of the lower end of the radius show a very wide variation which must be remembered during the interpretation of X-ray plates and also in determining clinically the amount of deformity.

The direct diagnosis of fractures about the wrist joint resolves itself into the diagnosis of fractures without any or all classical signs of fracture in a great many cases. For in a certain percentage of these cases the objective

signs of fracture are absent there being no deformity, false point of motion or crepitus and the sign of local trauma may be less marked than are often present following a severe sprain while in the absence of such finding the X-ray plate will often show a fracture. The extent of the swelling, extravasation and ecchymosis is largely dependent upon the amount of injury to the soft tissue and not the bone. The subjective symptoms of fracture as history of injury, pain and loss of function are always present in the injuries. The signs of an ordinary fracture and those of the Colles type are too well known to warrant a repetition now but there is one sign present here which is almost pathognomonic of fracture in any superficial bone and that is an area of extreme tenderness along the line of fracture. This point has been called attention to by Speed and others and is a very dependable sign in fractures of the rib; those about the elbow as well as in those under consideration and when all other signs of fracture are absent a very definite diagnosis can be made in the early hour by finding this point of extreme tenderness. It is so characteristic and so definite that the location and line of fracture can be outlined before the roentgenogram is taken. In all these fractures the roentgenologist should be consulted before treatment is instituted and in some cases during the progress of the condition. Miller's assertion that in no place in the body are serious injuries mistaken for minor ones of free

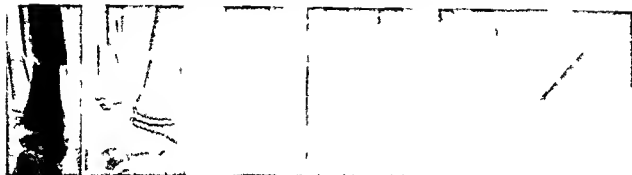


Fig. 1

Fig. 18

Fig. 19

Fig. 20

Fig. 21

Figs. 1, and 18 R. C. age 3 on Sept. 18, 1918 while playing ball stepped on a potato and fell on both hands. The usual signs of fracture were present together with two small punctured wounds on the dorsal surface at the level of the lower end of the upper ulnars. Where the bone had penetrated the flesh. Careful antiseptic treatment resulted in union without infection and return to normal function in five weeks.

Figs. 19 and 20 However the patient returned on February 4, 1918 having fallen while roller skating and again showed the signs of fracture with marked deformity which was reduced under anesthesia. The line of union in both bones is shown to be very near the site of the original injury.

Figs. 21 and 22 A. G. aged 6 a history very similar to that in cases shown in Figs. 16 to 20. The patient fell while hurrying home to dinner. The symptoms indicated backward dislocation of the elbow. The dislocation was reduced under anesthesia but the X-ray showed a transverse supracondylar fracture which gave evidence of never having been displaced. This illustrated the rarer types of injury that may occur in a child by a fall on the outstretched hand. The arm was dressed in extreme flexion and arched and frequent massage and passive movement to their with removal of the dressing in three weeks resulted in a straight arm with almost complete flexion and extension in 12 months.

#### DIFFERENTIAL DIAGNOSIS

To differentiate the various bone lesions about the wrist joint is quite essential from a therapeutic standpoint as displacements must be corrected and articular surfaces protected. In all cases of injury about the wrist joint the court of last resort the X-ray should be universally employed. However if

frequently as are injuries about the wrist would not be true if all wrist injuries were X-rayed.

Arbitrary statements and hurried conclusions about the presence or absence of bone injuries especially near joints are inexcusable when the services of a roentgenologist can be secured.



Fig. 2

Fig. 3

Fig. 4

Fig. 5

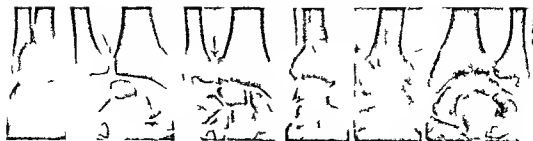
Fig. 6

Fig. 27

Figs. 2 and 3 Mrs. F. C. age 48 a usual history of a fall on the outstretched hand. Signs of fracture and typical dinner fork deformity were present. A circular cast was applied with the hand tightly flexed for ten days then in mid position. Note that the line of fracture enters radio-ulnar articulation. Immobilization was continued at the end of three and half weeks. As the symptoms and malunion were reduced early and frequently an attempt was returned to her work as a seamstress at the end of 11 weeks.

Figs. 4 and 5 Same case and 23 days and on half year later. The wrist is clinically and from X-ray finding practically a normal one. Both here and there illustrate what result can be obtained with conservative treatment.

Figs. 6 and 27 Mrs. R. S. aged 38 a usual history but unusual signs of fracture. A faint line of tenderness marked signs of trauma slight. No reduction necessary. Attempted circular cast in three weeks. Frequent massage and passive movements allowed. A distention rest reduced with only slight deformity remaining.



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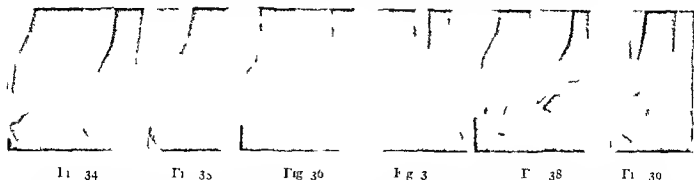
th surgeon be true to himself and to his patient he will not become dependent upon the X-ray but he will make sure of his clinical finding first draw his conclusion as to treatment and resort to the X-ray to confirm his finding or to prove positively the absence or presence of a bone injury in the more obscure case and to trace definitely the line of fracture a knowledge of which is essential to proper treatment.

Many are forever prone after twenty-four to forty-eight hours mutilate a fracture very closely but to conclude that it is a fracture without positive proof is akin to the responsibility and damage the patient an injury. Not wishing here to belittle the importance of a prism I feel it my duty to state that a sprained joint should be protected not necessarily immobilized much longer than a joint about which a fracture has occurred.

#### TREATMENT

When we consider the wonderful advance in abdominal and other branches of surgery in the past quarter of a century we feel elated and are blithe to acclaim what has been accomplished but when we are confronted with the fact that such fractures as are under consideration were as carefully described and securely as well treated or even better

back in the days of Sir Astley Cooper when he wrote his *Treatise on Fractures* in 1844 as they are today and with the statement of the late J. B. Murphy made in 1911 that 85 to 90 per cent of Colles' fracture as treated today result badly are we going to shift the blame or are we going to stand like men and admit the good? The field of operative surgery has so engrossed the attention and enthusiasm of the surgeon of today that the subject of fractures has been woefully neglected both in practice and in teaching. The average student of today when ready to leave college knows much better the detail of an operation for appendicitis or hernia or even hysterectomy than he does the detail of the treatment of the most common fractures yet he is no sooner comfortably located in his new office than he is called upon to treat a Colles' or a Pott's or a fracture of even more serious nature and he applies the best he can what he has learned to the everlasting detriment of his patient and at times a disputation that may end in a suit for malpractice. To the young physician or surgeon entirely at fault. No. The principal responsibility fall back upon those whose duty it is to teach the subject of fracture more thoroughly. A. H. Chester has intimated that the term Colles' fracture were dropped from the decrip-



Figs 34 and 35 C. S. a 24 injured by a truck. The usual signs of fracture were absent there was no deformity but the signs of trauma were quite well marked. Note that the line of fracture reaches the distal articulation. No reduction was necessary. A firm circular cast extending from the bend of the finger to the middle of the forearm was applied and the patient returned to work driven by truck after the fourth day. The left hand for cranking and steering the machine. Various massage and passive movements were given for five days and the cast removed at the end of four weeks.

Figs 36 and 37 Mrs. L. D. age 60. The usual history. The deformity was very marked. The line of fracture was also marked. Note the peculiar shape of fracture and displacement with articular surface of the looking backward. The patient was into tested and a

fair reduction was accomplished without anesthesia. A circular cast applied with hand flexed was worn for three weeks. The usual massage and passive movements were administered. Functional result good.

Figs 38 and 39 Mrs. K. T. age 40. The usual history. The deformity was moderate and typical signs of fracture obscure. Note irregularity in line of fracture and that radius shows but slight shortening. An unsatisfactory attempt at reduction was made. A circular cast with hand slightly flexed was applied. Immobilization continued at the end of 10 days. The patient returned to work as housekeeper after four weeks. After one year the patient returned. An unaccountable shortening of the radius is manifest with relaxation of the radio-ulnar ligament and quite free anteroposterior movements of the ulna.

tions of fractures about the lower end of the radius and the more common types described according to the pathology produced and thus present a firm basis upon which logical measures for treatment could be founded. The results obtained in the treatment of such lesions would be nearer the ideal. For this reason all fractures about the lower end of the radius under one heading and call them Colles and treat them as such is absurd. To treat a transverse impacted slightly displaced fracture in this locality as the so-called Colles is also absurd and ridiculous. That the treatment should vary according to the line of fracture if impacted or unimpacted the displacement the amount of injury to the soft parts and thus swelling and the age of the patient is logical and only when such principles are followed will the results approach the ideal.

#### REDUCTION OF THE FRACTURE

The details of the various methods of reducing Colles fractures are too well known or easily found in the various texts to justify repetition at this time. However to resume that a reduction is to be accomplished in all or in most fractures of the lower end of the

radius is wrong and a study of the various types of lesions will soon convince one that in a great many of these fractures the fragments are in as near normal position as could be desired. However in some of these fractures a good reduction or a perfect reduction is essential to secure a good functional result.

McCurdy states that Colles fractures when not properly reduced at the time of the accident result in more bad deformities than all other fractures combined. It is a well known fact that fractures of the shaft of long bones with great deformity will unite and give good functional results (see Figs 6 to 10) but not so with fractures about the joints and especially about the wrist. Brothers states that a perfect functional result is not enough but that a perfect anatomical result is also expected. True it is it would seem that a perfect functional result is scarcely compatible with anything less than a perfect anatomical result. Hertzberg and others lay great stress on the importance of good reduction in these fractures yet at times I have found that a good functional result may be obtained in some cases where reduction is far from perfect.



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### IMMOBILIZATION

That proper immobilization in some of these fractures is essential that some need very little if any and that other may be immobilized for too long a period are facts that must be considered carefully when one of the cases presents itself for treatment.

Lucas Champoussier in his earlier years was a strong advocate of the mobilization method of treatment of fracture and while in his later years his view changed somewhat he was a firm believer in the use of the simplest immobilizing apparatus and in most cases the immobilization should be continued only for a short period of time. A great many of the later writers, a Mennell, Cotton, Ireston, Speed and others are in favor of a short period of immobilization.

To treat any fracture without some immobilizing apparatus is contrary to the principle which we see manifest in nature and that are universally employed during the repair of wound in any tissue yet I believe many fractures are too well immobilized and for too long a period.

Fractures of the lower end of the radius may be immobilized by any material that will suffice to maintain the wrist joint in a rigid position but the padded splint or the plaster cast are unquestionably the most serviceable and it is my opinion that plaster

of Paris when properly applied is the splint par excellence for all of these injuries and should extend from the bend of the finger to the middle of the forearm in mild cases or to near the elbow in the more severe case. In the cases fractures that are transverse or that are not complicated with displacement the hand should be maintained in the normal relation to the forearm in midposition while in those of the so-called Colles' type with an original displacement and the articular surface of the radius looking downward and backward the hand should be maintained in the semiflexed position and if displacement is present recur in the pronated position. Immobilization of the elbow in these cases should be discouraged. Rotation should be carried out during treatment otherwise callus may be deposited about the radio-ulnar articulation and thus interfere with supination and pronation.

The plaster cast should be applied like a circular cast over a moderate padding of sheet wadding and before the plaster hardens a strip from one half to an inch wide should be cut out along the dorsum to provide for swelling that might take place and to enable the operator to remove the cast frequently for massage and passive movements and then reapply it readily. The replaced splint or cast can be made as rigid and close fitting

as is desired by means of adhesive plaster and a roller bandage. The cast should never extend below the metacarpophalangeal articulations and the patient should be encouraged to flex and extend the fingers frequently after the first two or three days.

#### POST-TREATMENT

After treatment which includes everything from the time reduction is accomplished and the first splint is applied is more important in securing a good functional result than is the first aid or the reduction and application of the first splints.

That a great many patients with poor functional results from these injuries are the victims of bad surgery is well recognized and that they are suffering not from the results of the original injury but from the treatment which they received in the hands of a careless operator. To prove this statement I need only cite one case of a man aged 46 who suffered from a fracture near the lower end of the radius from a buck line of his automobile. Three months later he presents himself with a useless forearm and hand but with little or no deformity and perfect union of the fracture. He states that his doctor immobilized his arm ablutely for seven weeks.

To those of us who see these injuries frequently that statement seems almost incredible but under no other conditions could a man get so useless a hand and arm when associated with this type of injury. Ashhurst in 1915 cited several cases of poor functional results and then relates that by various operations on the soft parts function was restored. Miller in 1914 stated

that the patient should be warned during the dressing period that a certain amount of fixation and swelling will be present and often persistent when the dressings are removed.

Wilensky in 1913 cited two cases that came under his observation which had been immobilized seven and eight weeks and were thus almost rigid and useless. My experience would tend to show that all such results can be avoided if proper early *massage and passive movements* are instituted and the immobilizing apparatus be removed at the

proper time. Lucas Champonierre was one of the earliest advocates of this line of treatment and was backed very forcibly by Mennell who gives a very comprehensive discussion of what is included in this method of treatment to which all men treating fractures would do well to refer. Lucas Champonierre claimed that *mild exercise* is essentially useful for repair but that a violent one is detrimental. Mennell states that in cases of fractures that involve joint surfaces the only hope of effecting a satisfactory reduction is to impart suitable movements to the joint.

We also find such men as Smith, Wilensky, Neuhoff and Wolf, Harg, Fiedler, Ireton, Cotton and Speed are strong in favor of early massage and passive movements. That the massage and early movements should be intelligently applied is an important feature and according to most advocates should be instituted between the second and seventh day. It should be repeated daily or every other day to the end of two or three weeks when the *splints should be removed entirely* and active motions with massage be carried out until full function is restored.

The manipulations should be gentle and yet thorough should cause little or no pain and after the first or second day the passive movements should not be extensive lest they produce movements of the articular fragments and lead to excessive callus formation.

Delayed union or non union in these fractures is not to be expected as it practically never occurs and in from three to six weeks depending upon the severity of the injury the arm and hand should be functionally restored.

#### OPERATIVE TREATMENT

It seems doubtful if operative interference is ever indicated in these cases if the treatment of the case even approaches the rational. Exceptional cases may be benefited but the question of function should take precedence over deformity in deciding on operation. Considerable return of function is compatible with distinct deformity.

## CONCLUSIONS

My experience in the treatment of fractures and the study necessary in the preparation of this article enables me to conclude

1 That the teaching of the subject of fractures is woefully neglected in the present day medical school

2 That every fracture in this region as well as in other is a law unto itself and each case must be treated according to its merits

3 That arbitrary rules and methods can not be followed in the treatment of fractures any better than in operative surgery

4 That the subject of operative surgery especially abdominal and head surgery has so engulfed the surgical teachers of the day that they have almost entirely overlooked fractures

5 That the average physician considers the treatment of fractures lightly and thus neglects many of the essential details

6 That patients today have a right to demand as efficient services in the treatment of their fractured bones as they receive for their appendix or gall bladder

7 That a competent roentgenologist is a valuable adjunct in the treatment of fracture but is not essential to obtain good functional results in a large percentage of the cases

8 That the surgeon who treats fractures should appreciate the importance of the many details that are essential to perfect restoration of function

9 That we are apt to err in immobilizing these fractures too well and too long rather than in the lack of immobilization and for too short a time

10 That careful after treatment is the essential thing in securing good functional results

11 That early passive movements and massage are absolutely necessary to secure perfect and early return of function

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## A CLINICAL STUDY OF PUERPERAL ANÆMIA

B. HARRY BUKKE SCHMIDT M. D. M. C. H.

Occasionally during the puerperium there is seen a form of anemia which has not received adequate attention. Oler in his excellent treatise on the *Principles and Practice of Medicine* (1) devotes about five lines to it under the discussion of the etiology of pernicious anemia. It receives only brief mention from Cabot in

Oler's system (2) and I am not aware that much notice has been given to it in any work. The disease is generally known as the pernicious anemia of pregnancy and it is treated under that heading by most authors.

My conception of the condition up to the time I had seen the cases about to be reported was that it was a severe anemia occurring

during the puerperium and resembling pernicious anemia the blood pictures of the two being identical that it differed from pernicious anemia in that recovery was the rule rather than the exception and not infrequently the patients exhibited a leukocytosis which is not seen in cases of uncomplicated pernicious anemia. Such brief description is in accord with the usual text books which mention the subject.

My interest in the disease was awakened soon after I had seen the second patient.

The patient Mrs W age 38 was seen in consultation with Reuben Peterson of Ann Arbor who referred her because of a fever and an anemia for which he and her family physician could not account. The patient on inspection differed in no particular from those cases of severe pernicious anemia with which we are all familiar. The praniculus was abundant the skin lemon yellow in color and extremely anemic. The mucous membranes were very pale. There was no general glandular enlargement. A pronounced hypercyanosis of the percussion note over the chest was noted and I am tempted to transcribe from my notes a description of the murmurs heard in the cardiac region of this patient.

There was a diffuse impulse in the third fourth and fifth interspace the apex giving an ill defined push one and one half inches outside the normal situation. The right border was percussed one and one half inches to the right of the mid sternum. There was no shock or thrill. At but especially to the left of the apex was a loud blowing systolic murmur heard very distinctly during inspiration less so during expiration but not absolutely disappearing. It could be felt well round the left chest and was fairly distinct between the scapula and the spine at the usual spot where it was audible at all periods of the respiratory cycle. On further examination however the murmur was heard all over the precordia and very distinctly in the pulmonary area. But beside this there was another and quite marked epistolic soft blowing murmur diastolic in time having its maximum intensity in the left third interspace at the margin of the sternum it was conducted upward and inward to the second right interspace where it was almost inaudible and it could not be heard in the vessel of the neck. The heart rate was rapid (112) the mitral first sound indistinct and the second pulmonary slightly accentuated. The pulse was collapsing but not of a typical Corrigan type and there was a capillary pulse seen under the nail and in the hip on gentle pressure. Duroziez's sign could be demonstrated in the femorals. There was no polycythemia and no great discrepancy between the systolic and diastolic blood pressures (110 60).

From past experience I was persuaded to

assume that the patient probably suffered from a malignant endocarditis. There was no petechial rash seen and the spleen could not be palpated. I except for a faint trace of albumin and an occasional cast the urine was negative. An examination of the blood revealed 1,500,000 red cells 2,500 white cells and a hemoglobin of 4 per cent.

The patient was the mother of four healthy children. Two weeks previously she had passed through a normal labor there being little blood lost at the confinement and none before or following it. There had been a continuous irregular fever for ten days ranging from 100 to 103.8 the pulse rate 105 to 128 and respirations 18. Dr Peterson insisted there was no evidence of an infection of the adnexa.

Mrs W was transfused directly from her husband soon after the examination and on the following morning the signs of aortic insufficiency had disappeared. The systolic murmur persisted. The red cells were 1,000,000 whites 150 and hemoglobin 30 per cent. She was again transfused a few days later with much better results. Following this she made a slow recovery. The patient was first seen in May 1913 and in August 1916 she was well. The heart was not enlarged there were no murmurs.

Shortly following these observations I was called by Dr Peterson to see a young woman Mrs S 30 years of age who but a few days previously had been delivered of her second baby.

There was nothing in her family or past history of importance. Her confinement had been normal and there had been no loss of blood before during or after accouchement. She had had a moderately severe bronchitis at the seventh month which had subsided in ten days. There had been an irregular temperature running a high as 101 at that time. The temperature after confinement ranged from 100 to 101. When I saw her she looked almost exsanguine. The physical examination was practically negative except for extreme hypercyanosis of the lungs some slight cardiac dilatation a systolic murmur at the apex well transmitted and an accentuated second pulmonary sound. The liver and spleen were not palpable and the urine was negative for bile albumin etc. The temperature was 101 pulse 110 and respirations 40. The patient was ill at it was pale as the pillow she lay upon there was no pigment in the skin. The red blood cell number 1,500,000 white cells 400 hemoglobin 10 per cent (D.R.C.).

Mrs S was transfused from her husband directly from the radial artery. Within 15 hours following the transfusion the red blood count was 3,600,000 white blood cell 3,000 and hemoglobin 38 per cent. The patient was again examined in August 1916. Her heart was normal. There were no murmurs. She had 4,400,000 red cells 6,500 white and hemoglobin of 83 per cent.



At the time the patient were seen there was a young woman Mrs. C. age in the medical service at the University Hospital, Ann Arbor, who complained of asthenia, pale and a sore mouth. Her mother had died at the age of 38 following childbirth from pernicious anemia.

She recalled the first patient in the hospital who had died of pernicious anemia. She had been in the hospital for a long time and had been treated with iron and cod liver oil. She had been in the hospital for a long time and had been treated with iron and cod liver oil.

The Wassermann reactions on the first three patients were negative. Blood cultures were taken from the third and fourth patients on several occasions but nothing was found. They all had heart murmurs. The first patient was thought to be suffering from an endocarditis of the aortic and mitral valve but as the illness had followed confinement puerperal anemia was suspected. Following the first transfusion the diastolic murmur and the vascular signs of aortic insufficiency disappeared. One year and three months later the heart was normal. There were no murmurs heard a year later during the examination of the second and third patient. The murmurs therefore were thought to be benign in origin. The hyperresonance of the lungs which was noted in every patient disappeared following transfusion.

It will be seen that all the patients except the last had normal confinements and that none had hemorrhages. The last patient had had no more pregnancies. None of them had a leukocytosis and all ran an irregular temperature.

The blood smears were interesting. A leukopenia and a relative increase in the lymphocytes was present in each case. The first and second patients showed a high color index with poikilocytosis in the extreme moderate anemias. Numerous nucleated red cells of which an occasional one proved to be a megaloblast. There was slight polychromasia. No macrocytes were seen in any of the smears. These blood pictures differ from those of primary pernicious anemia in one very important respect, the absence of macrocytes. In the cryptogenic form of anemia macrocytes are present in

skin. The spleen and liver were not palpable. Blood cultures and the Widal test were negative. The red blood cells were 1,200,000, whites 4,850, hemoglobin 5 per cent. Slight polynuclears 40 per cent, mononuclears 51 per cent. The transfusion of 400 cubic centimeters of blood (Unger method) by Willard D. Maye produced a remarkable improvement in the patient's condition for 36 hours when she again had a recurrence of the chill and high temperature. She expired on the fifth day following entrance into the hospital. At autopsy there was found a pelvic abscess and many metastatic abscesses in the lungs and other viscera. The bones were pale and showed signs of depletion.

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numbers averaging at least 5 per cent. The smears from the second and fourth patients resembled those seen in cases of the aplastic type of anaemia marked poikilocytosis some anisocytosis and leukopenia but no polychromasia or nucleated red cells.

Puerperal anaemia was first described by an American Walter Channing in 1842 (3). The number of recorded cases confined mostly to the French and German literature is not very large but reports have been made with increasing frequency in the past few years. Also in most instances the records are very incomplete and the cases reported have been poorly studied. In many no blood examinations were made at all and frequently only the leucocytes were counted and the haemoglobin taken. Nigh (4) and his associates have reported seven cases with autopsies. These are by far the best records I have been able to find.

An examination of the literature which includes about 138 references shows that the disease is rare though many cases are in all probability never reported. It includes all the cases frankly due to episodic disease as such would be extremely rare. It occurs most frequently between the ages of 20 and 40 but no age is exempt during genital life. Over 70 per cent had had more than one child. In 80 per cent the anaemia was first discovered following delivery hence the term puerperal anaemia.

The symptoms first observed in their order of frequency were pale vomiting diarrhoea and bloating but always sooner or later asthenia becomes the chief complaint of most patients.

The spleen was palpable in about 50 per cent of the cases. Murmurs were heard over the heart in every case where that organ was mentioned as examined therefore this may be the reason why the disease in its incipency is so frequently mistaken for endocarditis. Pigmentation of the skin was observed in over 50 per cent of the cases. Increased respiration or dyspnoea was frequently recorded as the chief complaint. Many of the patients had haemorrhages into the retina but in most instances the eyes were not examined. Symptoms due to cord

lesions have never been reported to my knowledge. Hydrochloric acid is often diminished and occasionally absent in the gastric contents. Haemorrhages occur but appear to be due to the same etiological factors as that which produces the anaemia. Ninety-seven per cent had fever during some period of their illness and in over 50 per cent it was continuously irregular. Approximately 68 per cent had a leucocytosis of 10,000 or above. In 5 per cent the leucocytes were below 6,000 per centimeter.

The prognosis is bad as 87 per cent of the patients die (5). Where the condition had been suspected before term abortion spontaneous or induced had no influence in improving the disease also the severity of the anaemia was of little value in determining the prognosis.

The reported autopsies show little other than what one would expect to find in any severe anaemia fatty degeneration red or aplastic marrow as the case might be. I could find no instance where disease of the spinal cord has been reported. Where an infection had been proven at autopsy endometritis was the common finding usually of the diphtheritic type. Endocarditis has been reported in a few instances and syphilis has complicated the picture only occasionally. It may also be noted that nothing has been found in the blood sera of these patients which would explain their anaemia.

#### DISCUSSION

There is little evidence in the literature to support the statement ( ) that the disease usually begins during pregnancy. On the contrary it is most frequently observed following delivery. The severity of the anaemia the high color index the leukopenia and the presence of nucleated red cells especially megakaryoblasts have been responsible for the confusion of this disease with pernicious anaemia. But we now know that megakaryoblasts occur in many forms of anaemia and I have seen them in smears from cases of pneumonia without anaemia. The diagnosis of pernicious anaemia should be made with caution when macrocytes and leukopenia are not present. Pernicious anaemia is a

severe form of anemia which after one or more remissions end fatally and it develop as a primary disease without a demonstrable cause in both men and women. We should hold steadily to this conception of the disease and should separate it from those forms of secondary anemia which produce a somewhat similar blood picture. Puerperal anemia should not only not be confused with primary pernicious anemia and I believe there is little excuse for confusing the blood picture of the two conditions. The absence of malarial and the frequent leukocytosis may serve to differentiate it. Other differences are the lack of remission and especially the absence of cordlemons. It is of course possible for pernicious anemia to be complicated by pregnancy and this may occasionally be confusing.

From a study of the cases so far reported one would be inclined to the opinion that an infection was the most probable cause of the anemia. In less than 10 per cent there was no evidence of infection other than fever. Blood cultures have been negative repeatedly. They were twice negative in our last patient. Nevertheless an infection was proven at autopsy. This patient had a leukopenia, a high color index and a severe poikilocytosis. The literature abound with descriptions of such blood pictures diagnosed as pernicious anemia.

The theory of a toxic cause for puerperal anemia has many supporters among them Grunitz (6) Sachs (7) and others. This doctrine of a toxin produced within the uterus by the pregnancy and causing an anemia in the mother is not well supported by the facts. It has been demonstrated conclusively that the removal of the uterine contents has no beneficial effects upon the course of the disease in fact in the small number of reported cases where the illness has definitely begun during pregnancy induced abortion has had a most unfavorable effect. Furthermore it is most frequently seen in its severest forms following delivery.

Another view (8) advanced as a cause of the anemia is a disturbance of the gland of internal secretion. In certain instances this hypothesis seems plausible especially in it

applicable in those cases where an autopsy has proven nothing but an anemia with its concomitant changes. On the other hand these cases are few and there has been no convincing evidence to prove that puerperal anemia is not the result of an infection. The present tendency is to push the intoxication theory too far.

In most instances the confinement is recorded as normal and the child living and well. The children of the first three patients herein reported are living and in good health and so far as we know were normal at birth. No blood examinations were made on the children as it apparently was not indicated at the time. Blood examinations from the child at birth have been reported by Spire and Perrin (9) also by Jungmann (10) in a case of von Jakach's anemia.

In conclusion it should be stated that too much emphasis cannot be put upon the importance of the life saving effects of the transfusion of blood in these patients. The rapidity with which the anemia can develop is surprising and the mortality reported is appalling. It is therefore urged that transfusion should not be used as a measure of last resort but early as soon as the diagnosis can be made. Treatment with drugs is frequently useless but they should not be abandoned particularly after transfusion when arsenic and iron are often efficacious.

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## GONORRHOAL EMPYEMA

H S WOODBRKY B A M D CHARLOTTESVILLE VIRGINIA  
I t t f s g r y U t y f v g

**I**N a review of the literature on pleurisy and empyema of the chest due to the gonococcus it was found that up to May 1913 only sixteen authentic cases have been reported.<sup>1</sup> Since that time I have been unable to find any further cases in the literature. Therefore I have thought it worth while to add my case to those already on record.

Although the gonococcus has a very wide distribution and in cases of septicemia due to the gonococcus one often sees the serous membranes attacked with a resulting endocarditis pericarditis peritonitis meningitis or arthritis yet the pleura is very rarely involved.

M M, a white girl eight years of age was admitted to the University of Virginia Hospital on November 10, 1917, complaining of pain in her abdomen. The family and past history was unimportant. Five days before admission to hospital the patient was seized with a severe cramp-like pain over the whole abdomen, being most severe over the lower half. For 4 to 48 hours she suffered to a considerable degree, then the pain became somewhat better under the use of local applications. She got along very well until the day before coming to the hospital, when the pain returned with marked severity. At this time it seemed to be most pronounced in the right lower abdomen but was present also to some extent in the left side. There had been no nausea or vomiting up to this time but on taking a purgative she vomited promptly and vomited once later. The patient gave no history of previous similar attacks.

Physical examination showed the patient to be well nourished and well developed. She was evidently suffering and looked ill. The abdomen was moderately distended with muscle pain and marked tenderness over the lower half, somewhat more pronounced on the right side. There was no dullness and no masses. Heart and lungs were normal. Rectal examination was negative. Temperature on admission was 103.4, leucocytes 8,000. The diagnosis of general peritonitis was made and at that time it was thought probable that a ruptured appendix was the cause. The child was operated upon immediately and on opening the abdomen

there escaped a thin, cloudy pus without any detectable odor. The omentum was found to be adherent over the right brim of the pelvis and the appendix was found in this region also. The appendix was freed with little difficulty. The tip of it was somewhat thickened and covered with fibrin but it showed no perforation and did not seem to be obstructed. The appendix was thought to be the cause of the peritonitis and the offending organism some form of the streptococcus which had gone through the wall without leaving any definite sign of perforation. Drainage was instituted and the abdomen was closed without any further examination of the viscera as the child was very ill and it was thought best not to prolong the operation.

Following the operation the clinical course of the disease was that of a general peritonitis. The abdomen became moderately distended and showed general tenderness. The patient suffered from cramp-like pains but never vomited nor did she seem nauseated. The temperature ranged from 101.5 to 103.5 and the patient presented the appearance of severe toxemia. On the sixth day after operation there were signs of a pneumonia or an accumulation of fluid at the base of the right lung posteriorly. On aspiration of the right chest there was obtained about cubic centimeters of a thick yellow pus. From this finding it was thought that the child had a right-sided empyema and that this might be causing the high temperature and severe toxemia.

She was then operated upon a second time and a thoracotomy of the right chest done. When the chest was first opened no pus could be demonstrated but when the child was turned flat on her back a few cubic centimeters of pus flowed out of the wound.

The respiration immediately rose from 30 to 48 and the child died in twelve hours from what seemed to be a respiratory failure. No autopsy could be obtained.

On the second day after the first operation the child was found to have a profuse yellowish vaginal discharge and on examination of smears made from this there was found only the gonococcus, the diagnosis being made from the morphology and staining characteristics. Smears made from the pus obtained at the time of aspiration and at the second operation showed again the gonococcus. A blood culture was made on the sixth day after the first operation using special media was negative. An attempt was made to grow the organisms seen in the pus from the chest but all the cultures remained sterile.

COMMON LESIONS PRODUCING BACKACHE<sup>1</sup>

B. WILLIAM E. SHACKLETON, M.D., CHICAGO

Our knowledge of all pathological conditions has been advanced mainly by observation made at the operating table in the surgical amphitheatre. For this reason our knowledge of certain lesions is limited where pathological conditions and anatomical variations are closely allied and particularly in this truth should the field be cut off the rest of the more common surgical procedure.

One of the most important and neglected of the field is that from the surgical and pathological standpoint is the back the region most frequently subjected to injury between the first lumbar and first sacral vertebra.

Injury in this region may be caused by disease of the pelvic organs, a myoma of the lumbar muscle, renal colic, ureteral and urethral stricture, lesion of the spinal cord and vertebral column and others. It is particularly the sciatic and sacral pain that I wish to call your attention.

Among orthopedic the various arthralgias in which the lesion is true point. It is the function trauma which characterizes and is subject to all the disease and incident to the same. The same action, a key line tightly bound in place by strong ligaments make the joint less vulnerable to ordinary type of attack.

Lumbar classification lesion of the joint is toxic, static and traumatic. The toxic group includes the chronic prostatic result of constitutional disease such as syphilis and tuberculous metabolism, for infection and infectious disease. It is mentioned here only for purposes of differential diagnosis. The chronic are characterized by pain of a burning, itching character which is first noticed in pressure. It is not relieved by change of posture. Examination of the history of infection, onset of temperature and laboratory findings assist in the diagnosis.

The static group include those cases practically always bilateral which are not associated with infections and arise entirely as a result of posture. Among the predisposing causes are hard labor, visceroptosis, pregnancy, lordosis, coxa vara in fact anything which tends to alter the center of gravity. These factors increase the ligamentous strain with gradual relaxation thus producing increased mobility of the joint. A common and acute cause is the complete muscular relaxation on the operating table produced by a general anesthetic.

The traumatic group is characterized by sudden onset following direct or indirect trauma such as a sudden twist when out of balance, acute unilateral direct strain falls on the buttocks or feet, difficult parturition, etc. The pain is sharp, lancing in character, followed immediately after the injury and is increased by motion. It is of greater intensity over the affected joint may radiate upward but frequently downward along the course of the sciatic nerve and occasionally is referred to the opposite side.

On inspection the lumbar curve is diminished or obliterated. The patient walks with a forward stoop, lists to one side and usually carries the hand over the joint involved making every effort to immobilize it. On sitting down he slides into the chair sideways. The roentgenogram shows a difference in the angle of the ilia in their relation to the spine. Sometime there is a visible separation of the sacral joint.

Proper reduction with temporary strapping confirm the diagnosis by relief of pain which is usually immediate.

Other potent etiological factor of painful back are the anatomical anomalies particularly of the transverse processes. Adams<sup>2</sup> reports a study of 50 consecutive cases in the Massachusetts General Hospital in which careful roentgen examination were made.

La g e k i l L f l i m b o l j l u J  
Am M A i  
R d b e l h Ch g i o c M y 3 8 (F d i o c p 633)

Of these 44 showed bony defects in the sacrum or fourth or fifth lumbar vertebra 7 showed anomalies of the fifth lumbar inferior articular process and of the transverse processes. At this ratio though the condition is not a common one it behooves us to be on our guard and not make the all too frequent diagnosis of lumbago sciatica or rheumatism.

Hoping to gain some useful information from the cadaver I have carefully studied this region in 6 dissected cadavers with particular reference to arthritis of the joints bursa the relation of the lumbosacral cord from its exit through the intervertebral foramina downward over the brim of the pelvis and the transverse process of the last lumbar vertebra their size shape and relation to the surrounding structures. From case of this study I found in two cases definite arthritis of the sacro iliac joint and in none of the cases could I find evidence of a bursa. The one constant finding was the relation of the lumbosacral cord lying as it does directly on the bones of the linea innominata thus accounting for Oppenheim's<sup>1</sup> remarkable observation that in all cases in which compression or other injury affects the sciatic nerve in the pelvis the paralytic symptoms are most marked in the peroneal nerve. The transverse process of the last lumbar vertebra varied from 0.5 to 4 centimeters in length and varied in shape from a simple pointed projection to the large fish tail process not infrequently seen in roentgenograms. The simple pointed process seems to predominate as it was found in nineteen of the cadavers. One had the large fish tail type on both sides three had the simple pointed process on one side and the fish tail on the other while another had the fish tail process on one side and a broad pointed process on the other.

The so called fish tail spine was first thought to be a pathological condition as evidenced by Henderson's<sup>2</sup> article on Bifurcation of the Transverse Process of the fifth Lumbar Vertebra. Further investigation has not borne out this fact for this type of process is frequently seen in roentgenograms of the back



FIG. 1. Dissected pelvis showing the nerves passing over the pelvic brim with entire absence of soft tissues to protect them from irritation.

and pelvis without as Henderson states causing any symptoms whatsoever.

The distance between the process and the ilium varied from complete bony union in two cases to a distance of 6 centimeters while the distance to the sacrum varied from complete bony ankylosis to a distance of 6 centimeters where the process was well above the iliac crest.

The anomalies of the transverse process which become pathological seem to develop during years of hard labor especially in people following occupations requiring unnatural posture during the adolescent period such as woodchoppers shovelers automobile repair men sailors linemen washerwomen etc. It is naturally found more commonly in the male during middle adult life. Direct traumata with laceration of the sacrolumbar and ilio lumbar ligaments or a fracture of the transverse process occurs as etiological factors. Cases recently examined show that both conditions occur and one case showed a fracture with complete separation and non union of the transverse processes on one side of the second third and fourth lumbar vertebrae. Undoubtedly infectious diseases bring about changes in this locality as in one case of general paresis recently examined (also shown in cadaver 3) which had an exostosis along the sacro iliac articulation and ankylosis of the transverse process to the ilium and sacrum. When alive this man undoubtedly manifested



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sympt m a there wa a decided atrophy of the gluteal and peroneal groups of muscle.

The factor involved in the production of pain can't vary. The transverse process may impinge on the ilium and acting as a fulcrum separate the sacroiliac joint. As in the case of Adam's an erosion of the ilium may occur from constant friction. Hyperplasia of the soft tissue from irritation may involve the nerve or the transverse process may act as a crystal rib set upon the brachial plexus.

The pain is located in the back directly over the process. It may radiate upward into the neck or downward to the saphenous notch or calf of the leg and the inner surface of the

foot and great toe. There may be some atrophy of the gluteal muscle and the muscle of the back of the leg. Changes in the reflexes, sensation and compensatory curvature of the spine all depend upon the length of time the process has been active. Advanced cases are not infrequently taken for beginning Lou Gehrig. One case reported by Goldthwaite was operated upon for a tumor of the cauda equina and in reporting the history of one of my own cases a neurologist was very certain up to the time of the operative report that I was dealing with such a tumor. It remains in all cases for stereoscopic roentgenograms to fix definitely the diagnosis.

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Treatment naturally resolves itself into constitutional palliative and radical surgical procedures. Naturally we believe that after ruling out constitutional diseases the treatment is essentially surgical and the only reason more work has not been done along this line is due to our unfamiliarity with pathological conditions. In acute sacro iliac subluxations or fractures of the transverse processes of the last lumbar vertebra or lacerations of the sacrolumbar or lumbolumbar ligaments no doubt proper manipulation with the application of a cast is indicated. In the

chronic conditions belts girdles corsets and casts bear practically the same relation in the treatment of these disease that the application of a truss bears in the treatment of hernia. Though operative procedures in this region are not particularly easy they are not unduly hazardous. And as we become more familiar with the pathology I am sure we will apply surgical measures for the fixation of relaxed sacro iliac joints and the removal of impinged fifth lumbar transverse processes in the same manner we now do herniotomies in preference to fitting trusses.

## A REMARKABLE RESULT IN OSTEOMYELITIS OF CARPUS

By DUDLEY H. MORRIS, M.D., NEW YORK.

From the Department of Surgery, Columbia University, New York.

ALL those who have followed the postoperative course of osteomyelitis are aware of the extreme chronicity which these cases frequently show. The slow persistent involvement of new areas of bone with resulting sequestration, the obstinate sinuses and the recurrence of pyogenic foci may extend over years during which the organisms lie dormant in the tissues only exciting acute inflammatory signs when the drainage is obstructed. Many of these cases remain well following the removal of sequestra, but in others the disease persists with a tenacity which defies the utmost surgical skill and which constitutes a serious challenge to medical science. It is in the hope that the intensive study of a single case may serve to throw some light on the pathological processes at work in all similar conditions that the present case is reported.

Mary C., age 34, domestic. In 1910 patient ran a needle into palm of right hand on its ulnar aspect. The wound healed. The patient had no further trouble until 1917, when she entered the Presbyterian Hospital with cellulitis of the right ring finger and ulnar aspect of hand. She was operated upon and a fragment of needle removed from space between fourth and fifth metacarpals adjacent to ulnar bursa. Another incision was made over the dorsum of the proximal phalanx of the fourth finger. The infection

did not subside and a sinus remained which to heal.

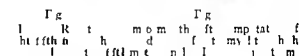
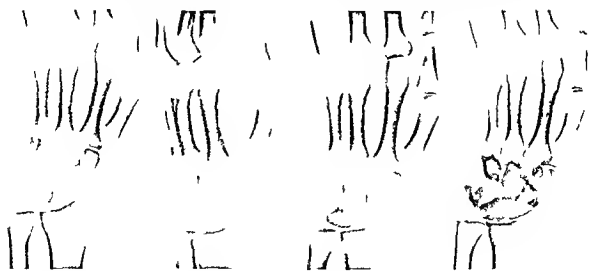
In May 1913 the condition was about as follows. The hand was markedly swollen red and tender, especially on its ulnar side. The fifth finger was tender and swollen to its tip; there was a sinus in the proximal to the fourth web which extended proximally toward the hypothenar eminence distally to the anterior aspect of the proximal phalanx of the fifth finger beneath the tendon of the flexor digiti minimi. The X-ray showed a beginning of osteomyelitis of the proximal phalanx of the fifth finger. The hand was repeatedly dressed but was not better. The sinus tract was incised, the granulation tissue removed and the wound drained. No pus was obtained. Histological report: granulation tissue, no tubercles. A sinus was found. The inflammation was abscessed somewhat but the sinus in the finger still persisted. During the following two months the finger remained swollen and tender and there was a periodic increase in the inflammatory signs.

In October 1913 the fifth finger together with the head of the fifth metacarpal was amputated by Dr. St. John. Skin flaps were loosely approximated with silk worm and 2 per cent formalin dressing applied. Following the operation the redness and swelling increased on the dorsum of the hand and on the ulnar side of the fifth metacarpal. The wound healed slowly and the sinus persisted in the line of incision. Nearly all known methods were tried in the effort to get this to close but none was successful. The X-ray showed osteomyelitis of the lower end of the fifth metacarpal and in the course of a month a further sequestra appeared with marked periodic thickening of the lower half of the bone (Fig. 1). By



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Fig 6

Fig 7

Fig 8

Fig 9

Fig 6 Roentgenogram 9 months later in similar condition as in last plate

Fig 8 Roentgenogram of wrist immediately following injection of bismuth

could be detected in earlier roentgenogram. Sinuses were present in the line of last incision and over the ulnar aspect of the wrist. In the next six months the entire carpus showed extensive osteomyelitis (Fig 4). There was redness, swelling and tenderness of the entire wrist and over the lower ends of the radius and ulna. The sinuses continued to discharge fetid pus and could not be closed. Numerous methods were tried including baking, massage, heliotherapy, immobilization, irrigation, carbolicization and passive congestion all without avail. The patient refused to consider amputation above the wrist and the process became stationary in about the condition above described. The patient was unable to do any work and dressings had to be renewed every few days.

In February, 1917 when I first saw this case there had been very little change from the condition in the early part of 1915 except that an ankylosis had taken place between some of the carpal bones. The physical examination at this time was as follows:

The right wrist was markedly swollen. There was moderate redness and tenderness over the dorsum of the wrist over the styloid process of the ulna and anteriorly opposite the remains of the scaphoid. Tenderness extended for a short distance up the radius. There was a marked fibrous ankylosis of the wrist. The fingers were boggy and swollen though not red or tender and there was only slight power of flexion. The patient was unable to do any work. On the ulnar side of the wrist there was a sinus discharging a thin foul smelling pus which however was rather scanty in

amount. A probe passed into this for a distance of nearly two inches to a point just below the lower extremity of the radius. Here was a large irregular cavity corresponding to the wrist joint at all parts of which the probe touched bare roughened bone. There were apparently no loose pieces of bone. The roentgenogram taken at this time showed extensive osteomyelitis involving all the carpal bones with ankylosis of the scaphoid, semilunar, os magnum, trapezoid and trapezium. The lower ends of both radius and ulna showed irregular roughening and erosion as did the bases of the third and fourth metacarpal. There was a very irregular cavity corresponding to the wrist joint which apparently had prolongations between the individual carpal bones and between the radius and ulna. No obvious sequestra could be made out (Figs 5 and 6).

The patient was rather pale and anemic and weighed 115 pounds but did not feel sick. No cough. The temperature was normal. No other pathological conditions were made out. Cultures from the sinus showed repeatedly the presence of staphylococcus aureus and a gram negative bacillus having many of the characteristics of colon bacillus.

From February 1 to May 1 we ran the gamut of nearly every known therapeutic procedure in the effort to cure this patient. She had among other things 3 exposures to twenty milligrams of radium for half an hour each, the tube being introduced into the sinus. No effect on the process was noticed. Continuous irrigation with Dakin's solution was tried with transient benefit. Churchill's iodine, phenol, iodofarm, glycerine and other strong antiseptics were introduced into the sinus cavity without result. Curetting and baking, immobilization, autogenous vaccines, heliotherapy, hygienic measures

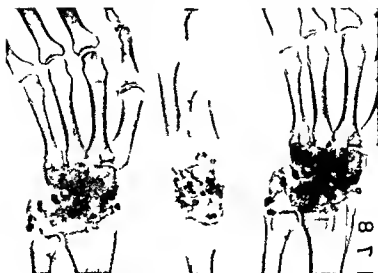


FIG. 8. FIG. 9. FIG. 10.

FIG. 8. FIG. 9. FIG. 10.

FIG. 8. FIG. 9. FIG. 10.

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v a s b e f o r e t h e i n j e c t (F i g 8 a n d 9)

I consider this case to have been cured by the  
obliteration of dead spaces which previously  
formed a fertile field where the bacteria could  
develop out of reach of the defensive mechan  
ism of the body and yet where their toxins  
could act upon the tissues. The organism  
being of low virulence and soon is subjected to  
the bactericidal influence of the tissues and  
the bismuth succumbed.

## NASAL FRACTURE

B. I. L. STANLEY M.D. SAN QUENTIN CALIFORNIA  
R. d. t. Phy. C. I. f. St. P.

**B**ETWEEN July 14 1915 and June 10 1917 two thousand prisoners entered San Quentin Prison. All of these men were given a careful physical examination on their arrival.

An analysis of these two thousand cases shows among other interesting findings that 15 per cent of them have deflected nasal septa. Some of these septa are sufficiently bent to cause permanent nasal obstruction while others are of less degree and cause mouth breathing only when the turbinate bones become swollen or there is other nasal congestion.

Eleven per cent of the prisoners examined have deformed noses comprising those with depressed bridge or deflection to the right or left. Very few of the deformities were congenital most of them being traumatic caused by blows on the nose received in fights or accidents.

For the correction of the septal deflections submucous resection is the operation of choice and yields excellent results as to function. For the deformed noses however there are numerous operations each one varying according to the peculiarity and degree of the deformity. These operations are for the most part long tedious and not always satisfactory.

Good results not having been obtained with the knife curette or chisel by intra nasal procedure for noses which had been broken to the left or right another plan was devised.

It was reasoned that for the most part these deformities had been caused by a blow on the nose producing a fracture. This fracture may have been through one or both nasal processes of the superior maxillary bone or it may have been a dislocation and possible overriding of the two nasal bones dislocated at their sutures with the frontal bone and the superior maxilla. At the time of the accident the fracture was probably

not well reduced and had healed leaving an unshapely and unsightly nose.

A study of a number of recent fractures of the nose among the prisoners revealed this to be the fact. One inmate with homicidal intent struck at the head of another



Fig. 1 and 3 Patients before and after operation



1 6 11 1 1 ff bf d ft pe 1

with a four pound sledge hammer. Luckily the recipient of the blow dodged as he saw the sledge coming and received the full force of the blow along the right side of the nose fracturing the nasal processes and comminuting the nasal bones. Another prisoner was struck with a baseball on the nose. This blow merely unloosed the nasal bones and slid them over to the left as shown in Fig. 6. Other similar accidents have shown the soundness of this reasoning.

The method devised for correcting these old standing conditions is to apply a sufficiently heavy blow to the nose to refracture it and return it to proper shape.

The process of refracture is as follows. After the standard preliminary preparation the patient is given an anesthetic of nitrous oxide or ether or both. As soon as the patient is under the influence of the anesthetic so that he will feel no pain the operation may be begun.

A cylindrical piece of wood (one inch in diameter by six inches long) well padded on

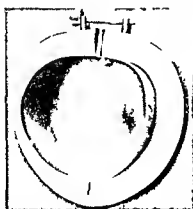


Fig. 5. Form for plaster casts.



1 6 Bf d ft p t P i t l d be  
t k th t b ll Th bt loos d th ll  
1 d th m t th l ft

the contact surface is placed against the convex side of the nose that is the side of the nose opposite to which the original causative impact was applied.

With several strokes of a mallet on this buffer the nose is refractured and may then be returned to its original position.

Sometimes it is necessary to insert a blunt periosteal elevator into the nasal fossa to lift the nasal bones up or to press them outward.

Due to the blow of the mallet there may be some bleeding but this is quickly stopped by packing both nasal fossae with thin strips of bandage previously boiled in petrolatum.

The light anesthetic having been stopped as soon as the operation is begun the patient very soon regains consciousness and is able to expectorate any blood which becomes accumulated in his throat.

As soon as the packing is in the nose a cofferdam of pasteboard is placed around the nose extending across the upper lip up on either side of the nose and up to the forehead. Plaster of Paris is mixed into a moderately thick mass and then poured over the nose and upon the forehead being prevented from escaping by the cofferdam.

The plaster soon sets making an excellent cast which holds the nose in good position. The cast is then anchored with two strips of adhesive one from malar to malar and the other across the forehead. By this time the patient is able to walk back to the ward. The whole operation usually consumes less than fifteen minutes including the anesthetic.

Twenty four hours after operation the packing is removed from the nose and the cavity sprayed with some mild antiseptic solution. The cast is worn for from two to four days and upon removal usually a good result is shown. The plaster directly in contact with the skin causes no disturbance for this length of time. In a former paper<sup>1</sup> the use of collodion splint was advocated but the plaster is now considered more satisfactory.

Pictures of the face are taken before and after the operation (Figs 1-5) and in order to better study the results death masks (Fig 4) are also made. To make plaster casts of the nose it is first necessary to have the patient lie on his back. The face is then covered with a coating of vaseline being careful to have the eyebrows and eyelashes well greased.

Th L a y g s c p e o r J

A metal form (Fig 5) is then placed over the face extending across the upper lip to the cheeks and malar bones and to the forehead. In case the form does not exactly fit plastic dental wax may be molded about this form where it does not impinge on the face.

Plaster of Paris mixed with water is then poured into the form and allowed to harden. When solidified the cast may be removed easily from the face. This produces a negative. In order to obtain a positive it is necessary in turn to grease this form well and pour plaster into it. When the plaster hardens the two may be separated and an exact reproduction of the face is made.

During the past three years about 49 cases of deformed noses have been operated upon with the refracture method. Most of the results have been excellent.

The technique is simple and no bad after results have been encountered.

## ACUTE INFECTIVE NEPHRITIS

By R. P. CAMPBELL, M.D.

G. L. L. na y S. Geo. M. tre l G. H. f. l.

AND

LAWRENCE J. PHEA, M.D.

A. t. P. f. f. P. th l. my M. G. H. U. y. D. t. f. P. th l. l. Lab. t. my M. t. l. Ge. l. H. p. t. l.

**D**URING a period roughly covered by the last ten years a large number of cases of infection in and about the kidney have come under our observation. We hope at some future date to analyze them in some detail. Among these cases are a number which do not properly come under the old term of surgical kidney, nor yet under the various types of perinephritic infection and pyonephrosis. They seem comparable to infections produced by certain pyogenic microorganisms elsewhere in the body in that the kidneys show numerous small areas of acute inflammatory reaction which may progress to abscess formation or to some stage or end result of such lesions.

We have selected a number of these cases for analysis. The work has proven all the

more interesting in that the urological literature contains a large number of papers which discuss from various points of view the type of lesion we wish to consider. We have profited by the suggestions and hypotheses given in these papers and where they seem applicable to our own cases we have made use of them.

The ability properly to diagnose and therefore properly treat surgical conditions of the kidney dates from the introduction of what it has been the custom to refer to as the newer urological methods, viz. the use of the cystoscope, ureteral catheter, functional tests, pyelography, etc. Indeed without these aids it is scarcely possible to make a diagnosis even reasonably certain, much less a diagnosis on which one can safely act. That the kidney



conditions we are to deal with have come into prominence only within the past few years is probably due to the fact that only during this period have we been able to diagnose them in their earlier stages. Such cases as did die were as a result of these conditions and came to postmortem did so in most instances only after the kidney had been largely destroyed or the disease advanced to such an extent that the early picture of small pyelitis or acute infection with or without urinary abscess was lost and that of pyelitis or pyelonephritis was substituted for it.

Out of the series of cases of various types of infected kidney exclusive of tuberculosis and the secondary to stone we have selected for analysis or reference two groups.

**Group One.** Infected kidneys which were diagnosed clinically by means of the ureteral catheter and by the use of the more recently developed ureteral technique and in which the clinical diagnosis was corroborated by operative and bacteriological and histological examination of excised kidney tissue or the entire kidney when this was removed. This group consisted of 44 cases.

**Group Two.** Infected kidneys diagnosed in a manner similar to those in Group One but lacking the confirmation made possible by operation. This group consists of 56 cases. They are considered in order to elucidate certain points that arise from the discussion of the cases in Group One.

This study is based however upon the cases operated upon.

Group One comprising the 44 cases operated upon may be divided as follows:

a. Thirty-one cases of subacute or chronic infection which though we feel that they are in many instances related to the following group have not been included in it.

b. Thirteen cases of acutely infected kidneys. The cases constitute the material to which we wish to refer in detail and upon which we would base whatever conclusions seem to us justifiable. To this group is added one case which we did not see until the postmortem.

We have selected certain of the 13 cases for detailed examination.

**CASE.** M. W. female aged 30 years was admitted to the Medical Ward of the Montreal General Hospital into the service of H. A. LaFleur September 1, 1900 complaining of severe pain in the region of the right kidney. This pain was constant but subject to exacerbations. The pain was accompanied by nausea and vomiting which had begun on September 8, nine days before her admission to the Hospital. Her temperature ran all from 100° to 101°. There had been blood in the urine but this had disappeared before she entered the Hospital. At the time of admission the urine contained leucocytes but no evidence of corpuscles. The urine as tuberculin of the bladder required repeated aspiration before a satisfactory specimen examination could be obtained. The mucosa was reddened but other signs of pyelitis were absent. The bladder had a capacity of 100 cubic centimeters. The ureters were dilated and the left one measured 4.5 centimeters. One cubic centimeter of pyelitis fluid was obtained. It had been administered per ureter the catheterization of the ureter. The catheters were passed and left in situ for the greater part of an hour. The analysis of the urine obtained during this period is shown in Table I.

TABLE I—ANALYSIS OF URINE CASE I

	Common	Right	Left
K	Acid	Acid	Acid
Sp. gr.			
Album.	++	++	+
U.	—	8	6
Sg.	—	X	X
	—	6	6
P.	++	+++	—
C.I.	B. coli	B. coli	S. l.
	(P.)	(P.)	
Sm.	N. b. l.	N. b. l.	N. b. l.

Urye examination showed nothing abnormal. In spite of this the clinical diagnosis of renal infection was maintained. The patient was treated with a catheter with a ureteral catheter.

On September 4, 6 days after her symptoms had first appeared, a cutdown on the right kidney was performed. The kidney was found to be enlarged. After the incision was made and the dissection was completed, the kidney was opened. The kidney was found to be enlarged and there was no evidence of obstruction to the ureter. A small selected piece of the kidney was fixed for examination. The kidney was then excised and the dissection was completed. The examination of the specimen showed a moderate supplicative inflammation of the entire substance of the kidney with polymorphous leucocytes.

TABLE II—POSTOPERATIVE ANALYSIS OF URINE CASE I

	C mm	R ght	L ft
R t	A d	A d	A d
Cl	T b d	T l d	Cl
Sp f G ty	—		
Alb min	—	+	+
U	—	6	
S & C lt	$\Delta$ 75 B ll l	B ll l	$\Delta$ 4 t l
M p l	M h p d N t b l b ll	M l l N t b l t ll	F l l N l l

There were small areas which showed abscess formation.

Following the operation the patient's temperature rose to 101° F and she continued very ill with recurring chills, high fever and persistent pneumonia. On November 28, one month and four days after her operation, an examination of catheterized specimens of the urine gave the findings shown in Table II.

On December 6, two months after her admission to the Hospital, the right kidney was removed. On histological examination the whole kidney was found to be infiltrated with polymorphonuclear leucocytes, lymphoid and plasma cells and there were areas which showed small abscesses as well as areas of subacute inflammation.

Recovery was uneventful. She has since married, borne children and remains well. An examination made during 1913, six years after one kidney had been removed, gave no evidence of disease in the remaining kidney.

**CASE.** A similar case is that of C. B., male, aged 35 years, admitted to the Montreal General Hospital, October 25, 1910 (M. G. H. S-1683-10).

Three months previous to his admission he had suffered from what was diagnosed by his attending physician as an attack of acute cystitis. This was followed almost at once by severe bilateral pain in the back. The pain gradually subsided to a dull ache which has persisted to the present time. On one occasion the pain became colicky in nature and was referred to the anatomical situation of the right ureter. This colicky pain was accompanied by a chill and sweating. At the time of his admission to the hospital his temperature ranged from 99° to 100° F. His chief complaints at this time were frequency of micturition, dysuria and pain in the back, chiefly in the region of the right kidney.

On clinical examination he was found to be a thin, rather nervous type of man but except for the condition of the urine, nothing definite was made out.

Examination of a catheterized specimen of urine

TABLE III—ANALYSIS OF URINE IN CASE

	C mm	R ht	L ft
R t	A d	A l	A l
Cl	Slightly t b d	Cl	Cl dy b
Sp f G ty		7	7
Alb m	+	++	
M p l	A f b M y p N t b b ll	P b c l	N p l E w l (T m t)
C lt	B l	B l	St l

from the bladder and each ureter gave the findings shown in Table III.

An X-ray examination showed an indistinct shadow in the region of the right kidney. Here as in the previous case a tentative diagnosis of renal stone with accompanying infection was made. On November 7, 13 days after his admission to the hospital, an exploratory operation showed an enlarged left kidney in which there were multiple cortical abscesses arranged in small groups. The pelvis of this kidney was slightly dilated. There was no stone and the ureter was free. Nephrectomy was performed at once (M. G. H. S-1680). The entire kidney was carefully cut up and examined. It was found to contain multiple foci of infection which varied from minute areas with slight central necrosis to small abscesses. Most of these areas were in the cortex though there were a few in the medulla. They were most numerous at the upper pole. Microscopically the foci of infection showed degeneration and varying degrees of infiltration with polymorphonuclear leucocytes and plasma cells. Cultures taken from a number of these areas of infection showed a pure growth of bacillus coli.

The clinical history and pathological findings of these two cases are representative examples of the remaining cases in the series. To us the two cases cited above are examples of acute and subacute infection of normal kidneys. There was nothing abnormal found that could be looked upon as predisposing the organs to infection, i.e., there was no demonstrable localizing cause.

The infection evidently did not come from the bladder. True cystitis was present in one case but both kidneys were not affected as one might expect them to be in the absence of any demonstrable lesion which might lead to the selection of only one of them. We now feel that cystitis when present in these cases is to be looked upon as a symptom rather than as a cause of the disease. It is in our opinion more correct to regard the cystitis



TABLE V—ANALYSIS OF URINE IN CASE 4

	Right	Left
Ratio	Ad	Ad
Color	Turbid	Turbid
Specific gravity	1.028	
Albumen	+	+
Urea		
Microscopic	Many pus cells, many bacilli, many leukocytes, many epithelial cells, many red blood cells.	Many pus cells, many bacilli, many leukocytes, many epithelial cells, many red blood cells.
Culture	Positive for bacillus coli	Positive for bacillus coli

CASE 4. Mrs. C. Examined January 10, 1901.

This patient had been ill with typhoid fever since November 6, 1900, with intermittent relapses. Since December 4, however, when she had been discharged, she had been well. On January 10, 1901, she had lately increased in amount the urine from the bladder carefully examined by catheter when examined by catheter, both bacillus coli and typhoid fever. The ureters were catheterized and no pus was found in Table V made.

The growth of typhoid fever in the right kidney from the urine obtained from the right kidney from the left one. The culture of the kidney was performed at rather irregular intervals. The patient was very ill. This condition was caused by considerable impairment of the function of the kidneys. The urine contained many pus cells and albumen were concerned in the present examination on February 10, 1901, when typhoid bacilli present in the urine. In the culture bacillus coli persisted. She died on February 14, 1901.

Postmortem examination showed bilateral subacute infective nephritis with marked purulent inflammation engorged upon it.

The interpretation of the findings in this case is in order to support the theory of ascending infections would rest chiefly on this fact that these infections are commonest in women and female children. The presumption might be made that on account of the short female urethra infection is able to reach the bladder from without and then extend to the upper urinary tract. One might argue thus especially in reference to bacillus coli infections. But cystitis in this case was of a very mild grade.

The following case is of interest in this connection.

CASE 5. This patient, a male, ran a typical clinical course of typhoid fever and from his blood bacillus typhosus had been recovered in pure culture.

At the time of the disease when convalescence was progressing rapidly and satisfactorily he suddenly developed chills, septic temperature and pus in the urine. He rapidly became very ill and died with signs and symptoms of acute septicæmia.

At the postmortem the general findings were the common to the convalescent stage of typhoid fever. Both kidneys, however, were studded with urinary abscesses. The character and distribution of the abscesses were similar to those referred to above. There was no evidence of constriction of the ureters, chronic nephritis or cystitis. Cultures from the heart's blood, abscesses of the kidney, and the urine gave a pure growth of bacillus coli.

These cases seem to throw light upon the point we have already referred to that bilateral acute infective nephritis may develop in cases of bacteræmia provided the resistance of each kidney is equally lowered. It is also of interest to note that there was no demonstrable predisposing lesion in the genito-urinary system and that in the very acute case (Case 5) there was no evidence of acute cystitis.

#### Symptomatology

The above cases illustrate sufficiently the symptoms to be looked for in the condition under discussion varying, as they do from those with acute onset with chill, rapid pulse, pain in the back, frequent micturition often accompanied at the onset by hæmaturia, and always marked by a pyuria of varying degree to a more chronic type where the chief symptom is perhaps persistent pain in the region of the kidney and recurring attack of cystitis.

The most constant sign is that of cystitis. Only with the cystoscope and ureteral catheter can these cases be diagnosed with certainty, however probable such a diagnosis may seem from ordinary clinical observation.

#### Prognosis

Useful as this series may be as confirming clinical diagnosis, yet it does not yield altogether reliable data as to prognosis. Undoubtedly cases of acute infective nephritis may and do recover without operative interference as the following one will illustrate.

CASE 6. Mrs. W. aged 40, admitted to Montreal General Hospital October 15, 1901. For one month she had had frequency of micturition and dysuria.

TABLE VI—ANALYSIS OF URINE IN CASE 6

	C mm	R h	Lef
R	A d	A d	A l
Cl	l b d	St f l	Cl
Spe		6	
Alb m	+	+	
M	f h b l l	M h b b l l	T f l oc N l l l
	f l l l	f l l l	

acc mpr m d by a f l g f i t e t n n l ne  
in th r g t l Sh a n t sh n l t b r b e l  
u l l t t e t h v n t g h l l n p r t f r  
one k h a l d l p e l g f i l l c l b y  
h g h t m g a t t e h l l h f e g u c t h c l  
s n t h n l h u n h b c n l u l d n  
t a n d n l b l

On n t t h r f o u n t a p l a b l t n  
d e r n t h g f t h e r i g h t k i d v H r  
p u l a s h t m p t u F  
l j t f e n a t u n h e l t h b l a d d e  
t b l l t h y f l m e d A n l y t h u n e  
o b t d l t h e t r n g a v e t h b d n g s  
h o T u l l e V I

A l g f r i g h t i d e d r y d n e p h u  
m d e n l t a l t m e d t o t c h i n e f  
t h e d e f t m

H i m p r t u e c m d n a r l u a l l T h m a  
n t h r i g h t i d g l u l t d m n h l n l t h e  
u l d d u p s h a t t h t O t l t  
n d v a t h l n n l t e n p t  
n r m a l B t h t h t h t h t h t e d  
w a p r a c t i c l y f r m a l l a t h g l  
c p e l l y f l u c l l l b f d B t n  
t h d t a d N m l q o p l l l  
t h a n n t h t r l f l h  
a n g a l t h h l l h g h t j r t u d n  
n e f p n t h M t r t h l t h  
e r h e t e l l y d n t h u a b e  
q u i t n o r m a l d t r l t t h e p r e t

Such a c a c h w t h i r c o v r y i s p o s s i b l e  
w i t h o u t u r i n a l i n t e r v e n t i o n a n d w e c o u l d  
a l d u c e m i l a r c a c T h e i g n a n d s y m p t o m s  
i n t h i c a c w e r e j u s t a s a c u t e a s m e  
o f t h o c w h i c h l m d e d o p e r a t i o n I t i s  
e q u a l l y c e r t a i n t h a t o t h e r c a c d o n o t  
r e c o v e r w i t h o u t u r i n a l i n t e r v e n t i o n a s i s  
i l l u s t r a t e d b y t h e f o l l o w i n g c a s e

C A S E M L g d 30 a d u t t e d t h M n  
t e a l C n l H p t a l O t b e r 3 o S h e g v  
b i s t o r y n a l l e s s t i s s i m i l a r t o t h a b p t  
t h a t t h e p r u b i l a t e r a l a n d t h e r g n f b t h  
k i d n e y s S h s t h o r u g h t e m d r a d a  
d g n o s i s o f a c u t e b i l a t e r a l f e c t i v e n e p h r o m l e

TABLE VII—URINE ANALYSIS CASE 7  
OCTOBER 1911

	C mm	R ht	L ft
R	A d	A d	A d
Cl	P l b d	P l b d	P l b l
pe	oo	oo	oo
Alb m	+	+	+
L			6
M	P l	I l	P l
C	f l l l b l l l	s m h f l l l	s m h N b e r c l l l

TABLE VIII—URINE ANALYSIS CASE 7  
DECEMBER 1911

	C mm	R h	L f
R	A f	A d	A d
Cl	T b d	T b d	T b l
pe f o n			
Alb m	+	+	+
M	P	P C p f p e l C p m	P C p f p e l C p m

S h e e f u s e d t r e a t m e n t a n d l e f t t h e h o s p i t a l S h e  
a s r e a d m i t t e d o n D e c e m b e r 3 r e r t o m o n t h s  
f i c h e r b a t a l m s i o n A t t h i t i m e a e a m u n  
u n h o d t h t t h e d i s e a s e a s s t i l l p e s e t  
T h t f l l o n g r a y a n a l y s e s a s h o w n n  
T a b l e V I I a n d V I I I m a d e u p n t h i c a s e a r e  
t h y f m p a r o

S h e c o n t i n u e d e f u s e d o p e r a t i o n a n d d i e d  
t h s i g n a n d s y m p t o m s f s e p t i c e m i a A p o s t  
r e m a s n t p e f o r m e d

I r o m t h e c t w o c a s e s i t w i l l b e s e e n t h a t  
s o m e w i l l r e c o v e r w i t h o u t o p e r a t i o n w h i l e  
o t h e r s w i l l n o t

## CLINICAL ASPECT

I n c o n s i d e r i n g t h e c l i n i c a l a p e c t o f a c u t e  
i n f e c t i v e n e p h r i t i s w e w i s h t o r e f e r t o t h r e e  
i m p o r t a n t p o i n t s t h e c h i e f f a c t o r s w h i c h  
d e t e r m i n e d t h e c l i n i c a l c o u r s e o f t h e d i s e a s e  
w h i t c l i n i c a l e v i d e n c e i f a n y w a r r a n t s a  
p r o g n o s i s a n d t h e s e l e c t i o n o f a p a r t i c u l a r  
l i n e o f t r e a t m e n t

T h e f o r m e r o f t h e s e t h e c h i e f f a c t o r s w h i c h  
d e t e r m i n e t h e c l i n i c a l c o u r s e o f t h e d i s e a s e  
i n o f a r a s t h e k i d n e y s t h e m s e l v e s a r e c o n  
c e r n e d w e f e e l i s c l o s e l y a s s o c i a t e d w i t h  
e i t h e r o n e o r b o t h o f t h e f o l l o w i n g T h e

TABLE IX.—ANALYSIS OF URINE CASE 8

	C mm	R ht	L ft
R t n	A d	A f	A f
Cl	St b l	T b d	Cl
Spec G Gra ty	005	00	000
Alb m	—	T	—
Ur	—	—	0
M p l	P t u l l b l l	I b l l b l l	N f l l f l l
Ch	R l l l	R l l l	l

kidney is unable to recover from the original infection either because of some local condition which as in Case 5, of our series was a ureteral stricture and the kidney was poorly drained as a result of it or the original infection may be so acute so extensive or so prolonged that the kidney tissue is damaged to an extent which renders complete recovery impossible. This is well shown in the cases occurring in typhoid fever cited above and in the following case.

CASE 8 Mrs B admitted to the Montreal General Hospital September 3, 1903. She was at this time pregnant and had suffered from pyelitis from the sixth month of her pregnancy. In the eighth month of her pregnancy this was found to be right sided. The left kidney gave no evidence of involvement. The right ureter was partially obstructed near the pelvis. The diminution of the function of the right kidney was very definite. Table IX shows the result of the examination of her urine.

The illness was so acute that premature delivery was seriously considered. Drainage however was established by inserting a ureteral catheter into the right ureter and leaving it *in situ* for some days. The pelvis of the right kidney was washed twice daily. This treatment obviated premature delivery and the patient went to term.

A complete examination in April 1911, one year and six months after her first examination showed that the affected kidney functioned almost but not quite as well as the left. An examination in November 1913 gave similar result. There was at this time very little evidence of infection only an occasional pus cell was found and there was no albumin. Pain however was most persistent and after all other means to relieve this had failed right sided nephrectomy was performed. The kidney presented the appearance of a moderately advanced granular kidney. On microscopical examination it showed numerous areas of cortical fibrosis which accounted for the deformed appearance of the organ.

If we are correct in our deductions the right kidney had been infected secondarily to the obstruction of the ureter and the damage done to this kidney by the acute and prolonged infection was sufficient to prevent the damaged organ from returning completely to the normal.

The second and third questions i.e. what clinical evidence if any warrants a safe prognosis and what particular line of treatment is to be selected are most difficult to answer. It is often possible with careful clinical observations and repeated complete examinations of the urine to form some idea of the progress of the infection and to determine the amount if any of retention present in the pelvis and from these findings to establish a line of treatment. In most instances we must be guided by the clinical course of the disease including the type of infecting organisms.

Our present line of treatment is as follows.

Where some definite infection of the kidney exists we are guided by the following:

- 1 The degree of diminution in function
- 2 The length of time infection has been present
- 3 The type of infecting organism
- 4 The evidence of lesion as determined by X-ray opaque bougies collargol pyelography etc.
- 5 The condition of the other kidney
- 6 The general condition of the patient

In the acute stage of the disease as illustrated in certain cases referred to above where there is no obvious interference with the drainage of the pelvis of the kidney we do not operate at once. On the other hand where definite and permanent obstruction to the flow of urine where life seems threatened by toxemia or where a more chronic invalidism exists and where a fair trial of other measures has failed we explore the kidney and if necessary remove it. In some instances nephrectomy may not be necessary but in several instances where it is not done after months of invalidism or weeks of acute illness we have had to go back and remove a kidney to which palliative measures had been applied as for example in Case 1 where at the first operation we had hoped

by decapsulation, nephrotomy and drainage to save the kidney.

Other means at our disposal are rest in bed, a plentiful supply of water by mouth, urinary antiseptics of which urotropin and urolone seem of benefit, and the establishing of drainage by posture or what has in several cases given temporary relief, the inserting of a urethral catheter by means of which there is established drainage for a period sufficiently long to give the kidney an opportunity to recover.

Vaccines have proved efficacious in two or three instances but not in our hands during the acute stage. They have been used with the hope of preventing relapses. They should be given early and the dose controlled by the reaction. Roy has his spoken very favorably of vaccine and has in authority of sufficient weight to lead us to believe that we have not got as much pathology out of them as we might have. In many cases we have been disappointed even in the more chronic type.

#### PATHOLOGICAL FINDINGS

The gross pathological findings in a kidney in acute infective nephritis vary with the distribution, size and extent of the lesion and the duration of the disease. In the acute stage the kidney is increased in size. This may be so slight as to fall within the normal limits of variation or it may be quite marked. The largest kidney in our series weighed 60 grams. This was a kidney in which the lesions were very acute and widely distributed.

The appearance of the capsule varies largely in proportion to the acuteness of the lesion, the severity of the toxin and the extent of the involvement of the kidney tissue. The blood vessels of the capsule are often dilated and in some cases there are small hemorrhagic areas which bear a definite relation to the lesions of the kidney substance. In most instances these hemorrhagic areas are opposite the lesions in the kidney, though they do not always show this relation. In a kidney recently removed where the disease was very acute and widely distributed the intracapsular hemorrhage was so extensive as to involve the greater part of the subcapsular tissue. The capsule may how-

ever show no gross evidence of lesions of the kidney cortex even in the acute stage of the disease. Until the capsule in such a case has been removed for evidence of infection in the kidney may not even be suspected. From the clinical viewpoint this is of importance. We have operated upon several cases where there was no gross external evidence of disease of the kidney tissue proper but after removal of the capsule widespread acute lesions were found. It is important to the operator that this point be borne in mind. We failed to appreciate it in some of our earlier cases.

When the lesions in the kidney are large or when small and situated in the superficial portion of the cortex the capsule is as a rule abnormally adherent to the underlying kidney substance. While these adhesions are slight in the early acute stage of the disease they may in its latter stages increase in intensity and portions of the kidney substance be torn away when the capsule is removed.

The end result of acute cortical lesions in so far as the gross picture of the kidney with its capsule intact is concerned is well illustrated in Case 3 of our series. This patient had had acute infective nephritis one year before the kidney was removed. The locations of the previous lesion were indicated by leprosed thickened firm scar-like areas in the capsule and throughout the areas the capsule was firmly adherent to scar tissue in the cortex of the kidney, the anatomical situation of healed focal areas of acute infection.

The most striking lesion in acute infective nephritis is to be seen in the kidney tissue proper. On the surface of the organ there are irregularly distributed focal areas of acute inflammatory reaction. These areas vary considerably in their location, size, number and general gross appearance.

In our cases there has not been any definite uniformity as to their location, although in the greater number of cases they are most numerous at the upper pole. All of them are elevated above the surrounding kidney tissue and in most instances are surrounded by a red zone. Some appear as small hemorrhagic points, others as small pale yellowish areas and still other larger ones which are

made up of discrete and confluent foci of the same general character as the smaller ones. An area composed of discrete or confluent foci of infection does not of necessity represent multiple areas of primary infection. On the other hand they probably represent the local spread of a single infected focus.

When an incision is made through them they are found to extend varying distances into the cortex of the kidney and many of them are fan shaped. While the distance to which they extend into the kidney substance is variable they as a rule involve for the most part the cortical substance. The gross appearance of a section through them varies with their duration and size. Some of the earlier ones show but slight necrosis most marked centrally while the older ones show more extensive change many of them having progressed to abscess formation. Between these cortical lesions the tissues show the changes found in acute septic infection. While the lesions in our series have been most marked in the cortex they are not always limited to this area. The medulla may be involved as well and here the lesions are similar to though as a rule smaller and less numerous than those in the cortex.

The pelvis is not always free from evidence of involvement. In some of the cases there has been no demonstrable acute inflammatory reaction though in other cases such lesions have been present. The character of the pelvic lesions are those of acute inflammation.

The changes in the ureters likewise vary. Where there is no obstruction of it there are no demonstrable lesions but where obstruction is present and the pelvis is involved there is an acute ureteritis above the constriction.

There is in some of the cases an acute cystitis but this is not always present.

When one takes into consideration the reaction on the part of tissues in general to inflammatory irritants the variation in size of the kidneys in acute infective nephritis may easily be explained and depends upon the factors that determine swelling associated with acute inflammation.

If the infection in the kidney is controlled and the patient recovers the final gross

picture of the organ will depend upon the balance between the various factors entering into tissue reaction to inflammatory irritants in general and the time that has elapsed since the primary infection. These same principles will determine the terminal gross characters of the pelvis and ureters.

We can imagine a lesion so mild as only to injure and not destroy. Function might be restored after such a lesion. The injury may however be so extensive and severe as to lead to widespread tissue destruction with its accompanying changes. Between the two extremes one finds all gradations.

The microscopic findings in the series of kidneys examined show a varying picture. In the earlier stages there is dilatation of the blood vessels diapedesis exudation and slight necrosis. From this type of lesion there are various changes from a more extensive necrosis to the formation of small and large abscesses. The kidney tubules which are most intimately associated with the foci of infection contain the products of exudation. In the older cases scars with the changes that characterize them are present.

#### BACTERIOLOGY

A member of the colon group of bacilli has been recovered in the majority of the cases either from the catheterized specimen of urine from the ureters or from the infected areas in the kidney tissue. It is of interest to note that whatever organism has been recovered it has in all our cases with the exception of one infective nephritis in typhoid fever been in pure culture. Of 54 cases where samples of urine from individual kidneys were obtained by ureteral catheterization and where the lesion was evidently in the kidney though in a few instances this was not definitely proved 45 gave growths of a member of the colon group of bacilli one staphylococcus aureus two bacillus typhosus 1 bacillus pyocaneus and one the proteus of Hauser.

Of the series of 13 acute cases confirmed by operation and referred to above in some detail 8 showed growth of bacillus coli either from the urine or the lesions in the kidney or from both one staphylococcus



aureus In the three remaining cases there is no note of the infecting organisms

Lindemann found the following figures in 47 cases

- 39 cases bacillus coli 81 per cent
- 2 cases staphylococcus aureus
- 1 case proteus
- 1 case bacillus coli and staphylococcus
- 1 case bacillus coli and streptococcus
- 3 cases sterile

#### DISCUSSION

There has been a good deal of interest in the fan shaped arrangement of the early lesion referred to above This arrangement has been used in support of the opinion that these lesions are primarily due to an ascending infection but we hope to show later that in most cases this is not true In an article in the *Berliner klinische Wochenschrift* 1911 No 44 Frank has shown that there is a direct lymphatic connection between the ascending colon and the capsule of the right kidney and a probable similar connection between the left kidney and the descending colon

There is therefore a possible easy route through which bacteria from the intestinal tract might reach the kidneys This is made more probable as the lymphatics of the kidney capsule and those of the kidney tissue anastomose Moreover Trumpe has demonstrated that colon bacilli are frequent in the urine of children with catarrhal enteritis

It is probable however that we must go further and regard these lesions of the kidney as secondary to a bacteræmia

In the cases of acute infective lesions of the kidney developing in individuals suffering from furunculosis typhoid fever tuberculosis mastoiditis and other kinds of septic foci there is little doubt that the infecting organisms are blood borne The fact of the absence of lesions in the pelvis of the kidney and urinary bladder in some of the cases especially the earlier ones not complicated by partial obstruction to the outflow of urine seems to be of some importance in its bearing upon the route through which organisms reach the kidney

On the other hand we would not deny that ascending infections of the kidney may and do take place but in the type of infection under consideration we feel that the evidence is very strong for a descending rather than ascending infection hæmatogenous or lymphatogenous rather than urogenous

There are certain further arguments that tend to support this view

1 Positive blood culture coincident with or preceding the kidney lesion This was proved in only one of our cases

2 The later development of lesion elsewhere in the body caused by the same organism as the one found in the genito urinary tract e.g. epididymitis which was present in one of our cases We have also had one case which developed femoral phlebitis

3 The analogy furnished by tuberculosis of the kidney which we think has finally been established as a blood or lymph borne infection

4 The fact that in certain cases lesions can be demonstrated in the kidney while as yet the lower urinary tract is unaffected

5 It is not necessary that a bacteræmia in the clinical sense precedes the lesion in the kidney Infections of the kidney occur in furunculosis and other types of local infection without clinical evidence of bacteræmia

The relation between these infections in the kidney and the improper drainage of its pelvis is not a constant one We feel that when obstruction is present it is important for at least two reasons first in its relation to the development of the condition and second its influence upon the course of the disease The improper drainage of the pelvis must have some influence upon the functioning of the kidney and may lead to lowered resistance and susceptibility to infection The relation of obstruction to the clinical course of the disease seems to us to be of more importance than its relation to the primary infection When once the kidney is infected the possibility of its recovery without operation bears some relation to drainage Infected lesions of the kidney like those elsewhere require proper drainage to facilitate rapid recovery

SYNOPSIS OF CASES OPERATED ON FOR  
INFECTIVE NEPHRITIS

CASES 1 2 3 4 and 6 reported above

CASE 5 Mrs M age 33 years June 9 1905  
right kidney multiple abscesses nephrectomy  
recovery

CASE 7 L age 30 years October 9 1907, acute  
illness right kidney diagnosed October 9 Im  
proved relapsed nephrectomy December 17 1907  
after re examination which showed no change but  
smears showed large Gram negative bacilli in large  
quantities Recovery

CASE 8 Mrs W age 50 years December 28  
1907 acute illness left kidney history of an al  
buminuric retinitis 6 years previously during  
gestation Operation Kidney studded with small  
abscesses beneath the capsule nephrectomy recov  
ery In other ways this kidney looked like a well  
advanced interstitial nephritis but the urine  
showed no albumin or casts

CASE 9 F June 2 1912 Subacute illness with  
acute exacerbation Old history of blow on the  
kidney Old history of transitory albuminuria  
right kidney nephrectomy and drainage re  
covery

CASE 10 Miss B age 47 years December 18  
1907 acute illness right kidney small abscesses  
nephrectomy and drainage recovery

CASE 11 E W age 18 years May 13 1911 right  
kidney nephrectomy and drainage acute illness  
continued nephrectomy recovery kidney studded  
with small abscesses

CASE 12 S 12 1913 March 19 1912 Acute ill  
ness right kidney nephrectomy recovery

CASE 13 Mrs J age 40 years May 4 1911  
acute illness left kidney multiple abscesses  
nephrectomy recovery

CASE 14 E age 20 years February 19 1912  
acute illness left kidney nephrectomy multiple  
abscesses femoral phlebitis recovery

## CONCLUSION

1 There is a type of acute infective  
nephritis the gross picture of which is char  
acterized by multiple small or large areas of  
acute infection which may and as a rule do  
proceed to abscess formation

2 These areas are for the most part  
situated in the cortex

3 The infection is usually unilateral

4 Clinically, it is manifested by all the  
signs and symptoms of an acute illness

5 The lesions produced may resolve or  
may leave the kidney so damaged that com  
plete recovery is impossible and may serve as  
foci upon which further infection may develop

6 The commonest infecting organism is a  
member of the bacillus coli group but other  
organisms as staphylococcus and bacillus  
typhosus may produce similar lesions

7 The infection is in most of the cases  
probably lymphatogenous or hematogenous  
and in some of the cases of bacillus coli infec  
tion some abnormal condition of the gastro  
intestinal tract seems to play a distinct part

8 There are frequently no demonstrable  
lesions of the genito urinary tract which  
might contribute toward the localization of  
infection in the kidneys

9 Treatment may be palliative but opera  
tion may be necessary

10 If nephrectomy is required and is  
performed early in the disease the prognosis  
is good

## HÆMATOGENOUS INFECTION OF THE OVARY

By SOLOMON WIENER, A.B. M.D. F.A.C.S. NEW YORK  
 Associate Gynecologist, Mount Sinai Hospital

**H**ÆMATOGENOUS infection of the ovary can occur just as any organ or tissue of the body can become the nidus of growth for pathogenic bacteria carried in the circulating blood. The frequency and importance of such infection of the ovary have not received due attention or emphasis.

The work of Rosenow and Davis<sup>1</sup> should serve to kindle interest in this subject anew. They state: "That some infections of the ovary may be of hæmatogenous origin from a distant focal source and not by direct extension from the genital tract" is supported by many clinical observations and the demonstrated fact that bacteria from foci of infection tend to infect electively the corresponding organs in animals when injected intravenously.

They draw attention to the frequency of tonsillitis followed by symptoms of pelvic infection, also to the occurrence of pelvic infection following anginal attacks during the menstrual period. Their theory of hæmatogenous infection with the streptococcus viridans as the cause of chronic fibrocystic degeneration of the ovaries has not as yet been substantiated by other observers.

In summarizing they lay stress upon the finding of the streptococcus in the fibrocystic ovaries of a young woman with a complete atresia of the vagina. This is the only clinical case included in their paper as published in the *Journal of the American Medical Association* in which the hæmatogenous source of the infection would seem to be definitely proven.

It will not do loosely to classify cases as hæmatogenous in origin where there is a possibility of infection by direct extension from the genital tract. In order rigidly to exclude infection by extension the following conditions must prevail: (1) intact hymen (2) no coitus (3) no history or evidence of gonorrhœa or

vulvovaginitis in infancy or childhood (4) no vaginal discharge whatsoever (5) no local or intrauterine medication or instrumentation (6) no focus of suppurative inflammation within the peritoneal cavity.

The necessity of most of these conditions is quite obvious. The mere fact that the patient is a virgin by no means excludes the possibility of ovarian infection from below. Infection through the introduction of foreign bodies into the vagina (douches, masturbation) is an ever present possibility. A most careful examination must be made to exclude inflammation of the urethra, vulva and cervix. In the presence of any vaginal discharge whatsoever one cannot be certain of the hæmatogenous nature of a deep pelvic infection unless the vaginal secretion has proven free of pathogenic organisms by culture.

Any labor or abortion, even if many years have elapsed before the occurrence of symptoms of ovarian infection, may still have been the causative factor.

The ovary is by virtue of its physiology peculiarly susceptible to infection by extension from any intraperitoneal suppurative process. This holds good even if the primary focus be at a remote portion of the peritoneal cavity. It is well known that in carcinoma of the stomach the ovary is frequently the seat of secondary growths. I believe that it is now the generally accepted view that these occur by implantation and not by metastasis through the blood or lymph stream. The periodic bursting of corpora lutea with the formation of a raw area extending more or less deeply into the parenchyma of the ovary would seem to offer a fertile field for the sowing of any existing intraperitoneal infection.

When all these conditions have been excluded there still remain the cases of undoubted hæmatogenous infection of the ovary. These usually occur in pre-existing cystic conditions especially in the remains of the corpus luteum. Thus far the best known and most frequently

reported form of such infection is with the bacillus typhosus. In a previous communication<sup>1</sup> I reported such a case. A girl of thirteen years of age shortly after her convalescence from a typical rather severe typhoid fever was operated upon for a large dermoid cyst of the ovary. Cultures from the cyst contents taken immediately after its removal showed bacillus typhosus.

I wish to report now a case of hæmatogenous infection of the ovary with the streptococcus hæmolyticus.

Melanie R. Surgical Number 165350, aged 18, high school girl, admitted to the Second Gynecological Service, Mount Sinai Hospital, July 19, 1916. Family history - negative. Past history - two months before admission the patient had an attack of right sided abdominal pain which was treated with the ice bag. Menstruation began at 14 irregular in type occurring every 5 to 6 weeks, lasting five days, painless. Last menstruation two weeks before admission.

Present illness - for two months the patient has been troubled with constipation and abdominal cramps which became much worse during the past three weeks. No loss of weight, no sweats. The patient herself noticed a large abdominal mass.

Examination - The patient is thin, somewhat anæmic, the temperature is normal. Throat negative. Abdomen lax, tympanitic. In the right lower quadrant there is a large firm mass dipping into the pelvis. Hymen intact, no redness of urethra. Bartholin ducts or vulva no vaginal discharge whatsoever. (Examination with a small endoscope postoperatively showed no discharge from the cervix, the vaginal and cervical mucosa being everywhere dry, pale, smooth and normal.) The vagina barely admits one finger. Uterus not enlarged, anteverted, somewhat fixed. To the right of the uterus is a firm, slightly elastic mass, fixed, not tender, the size of a grapefruit. The finger passed into the rectum meets a marked constriction about six centimeters from the anus, in front of which a very hard fixed mass is felt.

There is no reaction to old tuberculin. With these findings and a normal temperature, our preoperative diagnosis was either a solid ovarian growth, in

all probability malignant, or an unusually firm ovarian cyst.

**Operation** - Extramedian hypogastric incision, omentum found adherent to uterus and right adnexa. Omentum freed and large ovarian mass found on right side firmly adherent to the broad ligament, the posterior surface of the uterus and the rectum. Slight congestion of the distal half of the right tube in contact with the mass. The uterine half of the right tube as well as the left tube and ovary were normal.

**Procedure** - Dense adhesions freed and mass delivered into wound. During this manipulation a small rent was made in the abscess wall and some greenish pus escaped. The abscess was clamped off by its pedicle and removed. There was troublesome oozing from bed of abscess. Because of this a gauze drain was placed in the bed of abscess and brought out through the lower angle of the wound. A normal appendix resected. The wound was sutured in layers.

**Specimen** - Abscess size of grapefruit, the wall of which is about one-half centimeters in thickness, filled with thick greenish yellow pus. Pathologist's report - ovarian abscess, probably infected corpus luteum cyst. Cultures of pus from abscess - hæmolytic streptococcus.

Convalescence was febrile for four days, then normal. The wound healed *per primam* except in the drained angle. The patient was discharged eighteen days after operation with the wound entirely healed, the uterus movable and a slight infiltration on the right side. Re-examination three months later showed the patient in excellent health, the scar firm and the pelvic contents normal.

The absence of inflammation of the fallopian tube is further corroborative evidence that the infection did not spread to the ovary by extension from below. We were unable to discover the original source of the infection.

It is highly desirable that similar cases should be studied and reported so that this condition may be definitely established as a pathological entity. Such reports will serve to clear up the question of the frequency or rarity of this condition. In addition to its clinical interest and importance, the possibility of such infection of the ovary is not without sociological significance in the life of the patient.

<sup>1</sup>A. J. dy. 15th. m. p. l. t. f. a. t. m. s. Am. J. Ob. & G. N. Y.

# DEPARTMENT OF TECHNIQUE

## THE TROCAR-HARPOON METHOD OF FOREIGN-BODY LOCALIZATION WITH A NEW HOLDER

By EDWARD S. BLAINE, M.D.  
Captain, Medical Corps, United States Army

THE trocar harpoon procedure of locating projectiles under the X-ray fluoroscopic screen was described by Sutton in 1915. Later Skinner described Sutton's technique and corrected errors in the earlier publication. Recently this method was described by Flint who used an improved harpoon. The earliest reference to the procedure is that of Perthes in 1902 under the title of *Fremdkörperpunktion* and later described by him as *Fremdkörperharpunterung*. Sutton's application differs but little from that employed by Perthes. It was while in the service of the British Expeditionary Forces during the early period of the present war that Sutton encountered tremendous difficulties in his work of removing projectiles from the wounded. He had nothing to work with but an inferior X-ray equipment which consisted of a small coil, some inefficient tubes and a very inadequate dark room which made platemaking almost out of the question so that he was denied the usual assistance that the modern X-ray laboratory affords the surgeon. Due to this condition of circumstances he sought recourse in the fluoroscopic means of projectile localization and removal and his name is now often associated with this method.

The roentgenoscopic screen is arranged to be held horizontally over the table about 15 centimeters above the patient the X-ray tube being underneath. The projectile to be localized is centered on the screen and the skin and under-

lying tissues are anesthetized with novocaine or other similar agent. A cannula to which has been attached a small wing at the breech is used. With trocar inserted the cannula wing is held by an artery forceps directly over the projectile in the central X-ray with narrowed diaphragm. The instrument is pushed through the skin into the deeper tissues and if structures liable to damage be encountered the sharp trocar may be replaced by the obturator (Fig. 2). Some operators prefer to incise the skin and dispense with the trocar. Great care must be observed that the instrument be pushed in a perfectly straight downward direction this being controlled by the shadows on the screen. If the point of the trocar be visualized beyond the shadow of the breech it is proof positive that the direction is wrong and that the point will not reach the projectile therefore the instrument must be drawn back slightly and again advanced in the correct line. When the point has reached the projectile the operator as well as the patient will be aware of the fact but to verify this one may slightly displace the tube and the shadow of the point will be seen to appear and will lie in contact with the foreign body. Movement of the instrument will also move the projectile. The obturator is now removed and a wire harpoon inserted in its place. Then holding the harpoon firmly in position to keep it in contact with the projectile the cannula is withdrawn leaving the harpoon *in situ*. The wire shaft of the harpoon may be cut off with the wirecutting pliers furnished with the set and may be bent at right angles to the skin and dressings applied. The surgeon now needs but to follow the shaft of the harpoon until he reaches the projectile.

Flint in advocating this method reports considerable difficulty in the course of operation on account of the dark color of the Sutton wire harpoon which often cannot be distinguished in the blood stained area. He therefore has had harpoons made of white metal such as is used

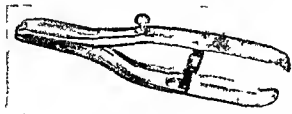


Fig. 1. Modified wooden holder for holding needle.

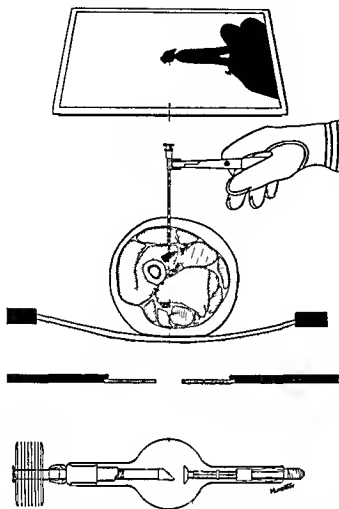


Fig 2 Upper portion of diagram represents the X ray shadows as seen on the screen. The diaphragm must not be opened enough to include the hand as shown. In the middle portion is the proper position of operator's hand holder and cannula, the latter directly in line with the central ray. In this position only will the shadow appear as indicated.

in the manufacture of surgical instruments the diameter of the shaft being the same as that of the obturator (Fig 3 A). This special harpoon has a small piece of metal hinged at the point which opens out away from the shaft thus sticking into the soft tissue and holding the harpoon in place. The color is such that it can be easily seen under any operative condition. These are used repeatedly while the wire harpoons are used but once.

The writer has experienced great difficulty in controlling the introduction of the cannula when using the artery forceps as directed by Sutton. This is because there is insufficient bite to the jaws when clamped on the wing of the cannula. If tissue of considerable resistance be encountered the instrument will slip and all control is lost. A successful means of overcoming

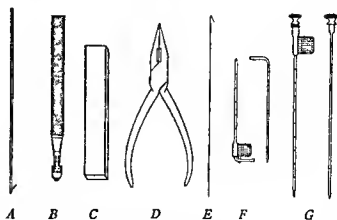


Fig 3 A Flint's special harpoon B chuck used in making wire harpoons C sharpening stone D wire cutting pliers E completed harpoon F and G large and small sized cannulae

this objection is found in the use of a modified Wedel needle holder, the jaws of which have been ground down to fit the wing on the cannula (Fig 1). The handle of this holder is long and well shaped to fit the hand and is long enough to permit the operator's hand to be beyond the direct X ray during the entire procedure. It can also be handled with ease with heavy X ray lead rubber gloves should it be desired to use this protection, but the careful operator will never open the diaphragm enough to expose his hand. The holder is locked by simple pressure on the handle and is as easily unlocked by button release conveniently placed. When set in position for use the bite is such that it cannot slip in any degree; in fact the cannula itself will bend before the holder will be dislodged. It is found that this holder affords a very positive control of the instrument in its passage through the tissues to the projectile and its use will insure success when the ordinary artery forceps will often prevent a satisfactory result.

An even more direct application of this harpooning method has been obtained by using the Flint harpoon with the modified needle holder just described. The cannula and trocar are both dispensed with by making a small incision through the skin directly over the projectile and then passing the Flint harpoon in identical manner as previously detailed. In the hands of a skillful operator this materially shortens the proceeding but it must be noted that the harpoon must be accurately directed as it will be impossible to withdraw the instrument should it go in a wrong direction. The smaller shadow cast by the slender shaft of the harpoon as compared with that of the trocar lends itself to a much easier control of direction.

When the supply of wire harpoons gives out new ones are made by taking some No 23 gauge piano wire and cutting it into 10 to 12 centimeter lengths. One of these is passed through the hollow handle of the chuck (Fig 3) allowing 1 centimeter to protrude from the end and the wire is held firmly by tightening the clutch. The protruding wire is now rubbed on the sharpening stone (Fig 3 C) until a very sharp point is obtained. Release the chuck and move the wire out a short distance farther and lock again. Set the width of the jaw of the wire cutting plier (Fig 3 D) on the point of the wire and bend it sharply backward doubling it upon itself. This completes the harpoon which is removed from the chuck for use. The hook must not be greater than will easily pass through the cannula. A large and a small size cannula (Fig 3 F and G) are provided with the standard set.

Objections may be offered to this method of projectile localization on several counts. Great care must be exercised in all steps of the procedure that they be performed under strictest asepsis. The danger of damage to vital structure must always be considered and it should only be used by those whose experience and skill in surgery is such that the use of this method is warranted.

While the trocar harpoon method is one of the official methods adopted by the medical department of the United States Army its use is not encouraged because of the reasons stated in the preceding paragraph. Nevertheless the simplicity, directness and absence of all mathematical calculation, scales, X-ray plates and other time consuming maneuvers appeals to many who are engaged in the work of foreign body localization and removal when large numbers of cases are to be handled in a short time under trying conditions.

## A SELF-RETAINING RETRACTOR FOR USE WITH ALBEE BONE OUTFIT

By MAJOR JOHN B. LOWMAN, M.C. AND CAPTAIN R. B. PRATT, M.C.  
U. S. Base Hospital No. 35

OPERATIVE orthopedics today can fairly well be divided into two schools pioneered and still led by the masters in these individual fields—Albee and Lane, the one the school of the internal fixation of autogenous bone graft, the other that of the use of metal plate. It is not purposed to discuss their relative values. Sufficient it is that with the great increase in operative orthopedics there will be a much greater

increase in the use of the Albee than of the Lane method. The Albee method is inseparable from the utilization of the electric driven saw, drill, etc., which he devised. With the great usefulness of this apparatus there are coupled certain dangers growing less with the increasing experience of the operator but still present when in the hand of an expert. These dangers are obvious to any one using or witnessing the use of the Albee outfit. To many surgeons upon whom the stress of war will throw orthopedic surgery, this will practically be a new appliance. To add to its safety, to render bone work on the extremities easier by removing assistants and increasing the freedom of the operator, the retractor herein

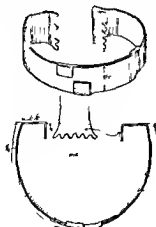


Fig 1

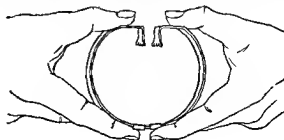


Fig 2

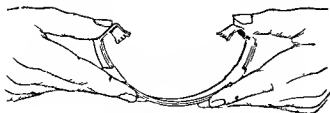


Fig 3

described was devised and has been found so far to fulfill the need in a satisfactory manner

The retractor is made of two arcs of spring steel fixed together by lateral lips in the manner shown in the mechanical drawing Figure 1

The toothed portions are broad to give greater and more even retraction. The teeth are rounded and the angle of adjustment between the retracting edge and the upper short horizontal surface is such that at no time is there any indentation of tissue except over an area sufficiently broad to prevent trauma. The lateral lips furnish a simple friction lock whose function is increased by any force exerted upon the two parts of the retractor except exactly in the direction of its arc by means of which the retractor is opened and closed. The accompanying drawings make this clear.

To apply the retractor the limb having been sterilized in its entire circumference is lifted the retractor sprung open sufficiently to slip on from below to nearly encircle the limb the toothed edges being brought to either side of the proposed line of incision. Two retractors should be used in the average case. They can be pulled upward and downward out of the way until the incision and the exposing dissections are made. The cut surfaces are covered by towels layed lengthwise and their surplus width is tucked in about the limb and inside the grasp of the retractors. The toothed edge of the retractor are made to engage in the depth of the wound on either side of the bone and each half is pushed backward into the reciprocating embrace of the other until the desired exposure is accomplished. Any unevenness of the protecting toweling is corrected. The operation is performed and when finished the retractor is removed by pulling upward on the horizontal place of one half and pushing backward in a circular direction upon the locking end of the other half on the same side of the limb. The retractors in position are shown in Figure 4

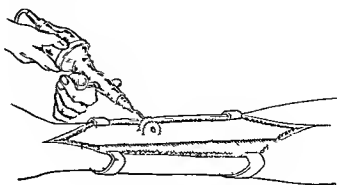


Fig 4

toweling having been omitted for clarity of diagram

#### ADVANTAGES

- 1 Simplicity. There are no parts to be lost. It is easy to clean and sterilize and manipulate.
  - 2 Durability.
  - 3 Moderate cost of production.
  - 4 It not only gives *retraction* of tissues but also *depression* of them with an uncomplicated automatic lock in any degree of retraction. Pressure upon its lower surface by the weight of the limb forcing it against the operating table only serves to increase retraction and locking.
  - 5 It does away with retraction by assistants and with this the danger of extra hands in the operative field, uncertainty of position, sudden moves and leaves the operator unburdened in the use of the electric saw and drill.
  - 6 It leaves the bone in a higher plane than the surrounding tissues and so obviates the danger of the saw drill or spinning shaft engaging with the soft tissues or toweling.
  - 7 In conjunction with an orthopedic table assistants can be dispensed with during that stage of the operation in which the saw or drill is in use.
  - 8 It is a useful addition in a teaching clinic in that it renders the field of operation more visible to spectators.
- In old cases density of tissues may prevent proper retraction but this no more militates against this than any other form of retractor.
- It will be found advisable to have a larger and smaller size for thigh, forearm and extremities of children.
- The routine adoption of this retractor with the Albee outfit is recommended.



## A NEW TRANSFUSION APPARATUS

By J SHERMAN WIGHT M D BROOKLYN

Long Island C H g Hospital Research Department

A BLOOD transfusion set should be simple and foolproof. Clotting obstructs the syringe and connecting tubes. This is overcome by changing syringes and tubes. There are a number of different instruments in use but most of them are awkward and complicated.

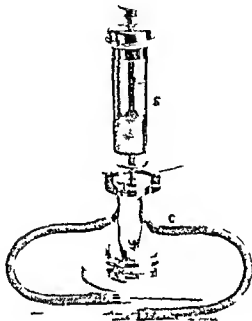


Fig 1

The instrument which I offer is shown in the accompanying cuts. The cannulae are provided with a small off set near the end so that they cannot slip out of vein when tied. These are connected to the instrument with rubber tubes.

No. 17 French. There is a heavy metal cylinder *C* and a metal piston *P* fitted with a collar and handle. The cylinder has two tapered holes in its wall to receive the two connecting tubes that go to the cannulae and two pieces of metal on top to act as guides for the handle of the piston. The piston has a tapered hole at the top center to receive the syringe. This hole meets a hole in its side at right angles which is on the same level with the holes in the cylinder when the piston is in place. The hole in the piston becomes continuous with the holes in the cylinder wall by turning the handle to the extreme limits of

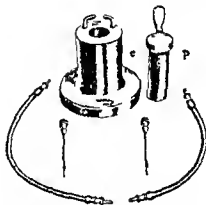


Fig 2

the guides. This instrument is heavy enough to rest on a table between the donor and recipient. Three to four hundred cubic centimeters of blood can be introduced without change of syringe. The instrument can be easily cleaned.

# PARALYSIS OF THE UPPER EXTREMITY DUE TO COMPRESSION OF THE BRACHIAL PLEXUS BY SCAR TISSUE

## OPERATION, RECOVERY

By FRED C WATSON M D QUIRIGUÁ GUATEMALA

Surgeon United Fruit Company H. P. Ltd.

THE present European War with its colossal total of wounds of almost every imaginable variety has caused us to realize the importance of wound of the peripheral nerves and has stimulated an added interest in this important branch of surgery.

In this connection the following statistics of Movnhan (1) as to the relative frequency of injuries of this type are of interest:

	P	Cent
Nerve		
Musculospiral	5	24
Ulna	4	18
Median	4	18
Sciatic	1	4
External iliohypogastric		
Internal iliohypogastric		
Upper part of 1st brachial plexus	4	18
Lower part of 1st brachial plexus	7	32
Anterior crural		

It will be noted that injuries of the brachial plexus form 22 per cent of the total number of wounds involving the peripheral nerves. Injury to the brachial plexus in adults is usually the result of indirect violence and in such cases is associated with skeletal injury such as dislocation of the shoulder, fracture of the head of the humerus or fracture of the clavicle. However, skeletal injury is not necessarily associated as was shown by Frazier and Skillern (2) in 1911. They were able to collect reports of 13 such cases all of which were verified by operation.

Law (3) in 1916 reported two very interesting cases of this kind and cited two other cases from the literature, one by Hartwell and one by Murphy. In these cases complete or incomplete avulsion of one or more of the component parts of the plexus results from the violent stretching to which the plexus is subjected. A similar condition is not at all uncommon at birth and likewise is due to indirect violence.

The plexus may be injured by direct violence such as occur when the clavicle is driven downward against the first rib. These cases are comparatively rare. In the case to be reported it would seem that both direct and indirect violence were responsible.

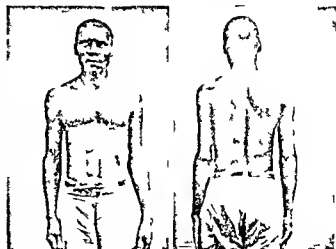
Unah Harris, case history No. 5417, male, black, Jamaican, age 32 years, occupation banana cutter, was admitted to the hospital March 25, 1915. On the evening of March 19, 1915, after drinking rather heavily, the patient

fell backward from the porch railing on which he was sitting to the ground, a distance of ten or twelve feet, striking on the upper and back part of the left shoulder. In falling the left arm and forearm were carried behind the trunk. Paralysis motor and sensory of the entire extremity was noticed the next morning when he had recovered from the effects of his drinking. Severe cramp-like pains, numbness and tingling were occasionally felt in the left shoulder radiating down the arm and forearm.

On examination a few superficial abrasions and contusions about the upper and posterior surfaces of the left shoulder were noted. There was no evidence of fracture or dislocation. There was complete anesthesia corresponding to the cutaneous distribution of the circumflex, musculospiral and ulnar nerves. Sensation corresponding to the cutaneous distribution of the internal cutaneous nerve was impaired. Above the acromion process and the spine of the scapula sensation was normal. There was complete paralysis of the following muscles: the deltoid, triceps, supinator and the extensors of the forearm and wrist. The biceps was active only when the arm and forearm were fixed at a right angle. The flexors of the forearm were normal. The pectoralis major and minor, the latissimus dorsi and teres major were active. The muscles above the acromion process and the spine of the scapula were also active.

Upon analyzing our findings then we concluded that the patient had an injury probably an avulsion of the inner and posterior cords of the brachial plexus below the origin of the long, middle and short subscapular nerves and the suprascapular nerve.

Operation was advised but was refused. The patient was kept under observation for nearly three months and as trophic changes became more and more marked his consent was obtained. The trophic changes are shown in Figures 1 and 2.



Figures 1 and 2. Anterior and posterior views of patient with compression of left brachial plexus before operation.



In Figure 5 a keloid growth is seen at the site of the operation wound. These growths frequently follow operations in practically all parts of the body in the negro race and aside from the unsightly deformity caused by their presence are not considered of much importance. Efforts directed toward the removal of keloid growths are usually rewarded by an increase in the size of the growth consequently they are usually best left alone.

In conclusion I wish to thank Dr W E Deeks General Superintendent Medical Department United Fruit Company for permission to publish this paper.

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## CORRESPONDENCE

## THE BALDWIN OPERATION FOR ARTIFICIAL VAGINA

*To the Editor* In the August issue of your Journal Dr A W Abbott of Minneapolis suggests a modification of the operation which I devised a number of years ago for the making of an artificial vagina. His modification consisting in utilizing a single piece of bowel instead of the double piece which I originally suggested. His modification is apparently a simplification of the operation but I had carefully considered it before publishing my original communication and had decided that the single bowel would almost certainly be too small particularly after time had elapsed for the contraction of surrounding connective tissue. My subsequent experience has fully confirmed that view. Nevertheless and in verification of this statement I may say that under date of August 1 I received a letter from Dr J G Blower of Akron in which he refers to this article by Dr Abbott and states that in case of a patient of his upon whom I had made this operation three years ago he had found it necessary (as I had suggested to him would probably be the case when his patient returned home) to remove by clamp the upper extremity of the septum which part had failed to disappear after my use of the clamp. The lower portion of the vagina was of normal size but it was too small above until he destroyed this remaining bit of septum.

I may state that since my original publication of

this method I have learned of the performance of a large number of these operations but have heard of only one fatality. That occurred at the hands of a German surgeon and was due to peritonitis. In one case in New York in a young girl of 16 the uterus was present and the technique which I devised for such a case was employed with a successful result. I am hoping to live long enough to hear of that young woman becoming a mother though doubtless it will have to be by caesarean section.

Columbus Ohio

J I BALDWIN

*To the Editor* In regard to Dr Baldwin's suggestion I would say that the vagina in the case I reported was one and one fourth inches in diameter at the end of three months. Contracture does not occur in the bowel but in the connective tissue at the vaginal orifice and where it perforates the peritoneum. It would seem that these contractures (easily overcome by suitable dilators) would be as likely to occur irrespective of the size of the gut or whether a full loop or one limb were used. A satisfactory decision can only be reached after a large number of cases operated by this method. Dr Baldwin's experience in this abnormality has been extensive and his opinion should certainly command the greatest respect.

Minneapolis Minn

A W ABBOTT

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING MAY 3 1918 CARL BECK PRESIDENT IN THE CHAIR

### FRACTURE OF THE UPPER THIRD OF THE FEMUR WITH A DISLOCATION OF THE HIP

DR MALCOLM L HARRIS The case I wish to report is that of a frail looking boy 12 years of age. While playing on a snow bank last January he fell and sustained what seemed at first to be a rather trivial injury. He was brought to the Alexian Brothers Hospital and it was found that he had a fracture of the shaft of the upper part of the thigh. While we could extend the limb the proper distance the coaptation splints did not approximate the ends as was shown by roentgenogram so the case was operated on and a bone plate inserted with bone screws. The boy was put in a body and leg cast. When I examined him the next day we were surprised to find that while the leg was perfectly straight and seemingly normal it was shorter than the other. I immediately investigated and found that the trochanter on that side was too high. I immediately had the hip X-rayed and found the hip was completely dislocated upward and backward the femur was in perfect alignment at the fracture. We then anesthetized the boy and tried to push the head of the bone back in place. This was impossible so I concluded to operate on the hip and reduce it which I did after the boy had rested a few days from the first operation as he was rather delicate. Through an anterolateral incision posterior to the tensor vagina femoris a dislocation of the hip backward and upward as found. The ligaments were all torn but with the short end and inability to make any traction by pulling on the leg or manipulation we could make no impression on the upper end. Even with a large Lane bone forceps I was not able to manipulate the upper end to get the head in place so I made an extensive dissection and used the hip skid. Only after I got the skid in back of it and over the edge of the acetabulum was I able to skid the head back into place. I considered this a serious enough operation for the boy so I sewed up the wound and waited. Naturally as a result of the manipulation and getting the head back in place the fracture plate came off. The manipulation pulled the screws out of the upper fragment. We were now still in a bad predicament we had the head reduced but our fracture was out. I put on extension to see what position the fragments would assume with the head back in place but found that extension would pull the hip down out of place. I therefore concluded

to do another operation on the fracture. After waiting a few days I cut down on the fracture again and replated it. While trying to get the ends of the bones together a large piece split off the upper fragment so that while at the first operation I had straight ends this time they would slide by because the piece had broken off. After considerable difficulty I got the plate on then I wired that fragment to the plate as that was the only way I could hold the whole thing in place.

I have just taken the last cast off. The boy has a movable hip and we have a good union of the bone. We met as you see many difficulties in this case. It is the only case that I have ever seen where we had a fracture of the shaft of the femur in the upper third with a dislocation of the upper fragment in a child. I have seen several cases of fractures in adults with dislocations and fractures through the trochanter and upper part of the neck but this is the only case I have ever seen of a fracture of the shaft of the bone with a complete dislocation of the upper fragment in a boy. I do not know of any way of handling these cases except by the two operations. It is impossible to get the head back without the skid which means an open operation and then it is necessary to operate on the bone.

If any member has had a case of this kind I should like to hear from him.

DR FREDERICK G DYAS Would it not have been possible to reduce the head of the femur in the first place?

DR HARRIS No. We tried it and Dr Hesser helped me but we could make no traction on it and we could not push it back in place. We had to give it up and do an open operation. There was nothing to take hold of to make any manipulation.

DR JOHN R HARGER read a paper entitled  
Sarcoma of the Liver in a Child of Seventeen Months

### TREATMENT OF FRACTURES BY MEANS OF A NEW RAILROAD SPLINT

DR WILLIAM HESSERT presented a new railroad splint which will be described in a later issue.

### COMMONER LESIONS PRODUCING BACKACHE

DR WILLIAM E SHACKLETON described the commoner lesions producing backache. (See p 602)

## DISCUSSION

DR JOHN A WOLFER I have been very much interested in Dr Shackleton's work and have watched it during the last six or seven years.

There are two points he brings out that ought to be considered again. One is the fact that the fifth lumbar vertebra is frequently overlooked in X ray work. You can have trouble with it and as one goes over the vertebral column and comes down to the fifth lumbar vertebra he skips it. This was forcibly brought to my attention in the last few days in a case of Pott's disease with caries of the fifth lumbar vertebra with a large abscess although a competent roentgenologist said there was nothing definite to be seen. There was a large retroperitoneal abscess and when we opened the abscess there was found erosion of the vertebra.

A second point is that hackache is often a fore-runner for so-called sciatica. I have observed this in a number of cases of so-called idiopathic sciatica. It recalls to my attention two cases one of a woman who came from Idaho. After she had been told that there was no relief for her sciatica she had taken salicylates and every other concoction until she could not retain simple water. The attack of sciatica was ushered in by frequent hackaches which were of the kind Dr Shackleton spoke of located in the lower part of the back about the fifth lumbar vertebra. She attributed her trouble to the fact that she had quite a large husky child and in swinging the child around it brought on hackaches and developed sciatica. X ray examinations with stereoscopic pictures showed the fifth transverse processes normal they did not impinge upon the sacrum or ilium. The sacro iliac joint was wider than it is normally. We could see an anteroposterior displacement. We made out definitely that the sacral nerves of the sciatic were involved. She was given palliative treatment only placed in bed with a pad on the sacrum and traction made on the leg until the leg straightened and relaxed and suddenly she had relief of pain. She was not given any sedatives although she was given morphine before as she was unable to stand or sit. She assumed a recumbent position and her pelvis was strapped with adhesive. She was sent to Pinehurst and returned in six months after having worn one of Goldthwaite's corsets. She could dance and do anything she saw fit. She has not had a recurrence of the hackache or sciatica.

Another case very similar to the one I have related did not complain very much of hackache until one morning he went into the bathroom and in stooping over developed a sudden pain in the right side which radiated down the buttocks and he fell upon the floor. He was a man 6 feet 4 inches high. They had so much trouble in making him turn and he complained so much of pain that it was necessary to anesthetize him to take him out of the bathroom. In this man's case the same thing was demonstrated. The fifth transverse processes were normal but he had unmistakable slipping of the sacro iliac joint.

He was put to bed under similar treatment and the pain disappeared. He was a lawyer from Idaho and did not follow subsequent instructions as well as he should have done. But with complete rest with a sacral pad he has not had a return of the sciatica or the hackache.

It behooves all of us as Dr Shackleton has said to see that these cases of hackache are properly treated and not given hackache medicine. We do not appreciate what hackache is until we have had it. There are things overlooked in hackache which come to light if we all watch our cases.

DR R W HOLBROOK, Kansas City, Missouri. I am particularly interested in this paper because of the trouble we have had with some of our troops for the last several months. The hane of our existence has been a hemolyzing streptococcus that we are having to deal with. Within the past six weeks we have had 15 men sent to the base hospital complaining of hackache a little dyspnea a slight weakness of the legs as they express it and a low grade temperature. Cultures were made from the throats of these men which disclosed a hemolyzing streptococcus. After three or four weeks in bed they developed a myocarditis and by instituting treatment similar to that described by the essayist the hackache and heart trouble have disappeared.

DR WILLIAM M HARSHA I would like to ask Dr Shackleton to clear up a little for me at any rate the situation with reference to the articulation. I noticed several times he said the transverse process of the fifth was ankylosed in its attachment to the ilium. Again he referred to it as articulating with the ilium. As I remember hearing Dr Goldthwaite in Boston speak on this subject he regarded as physiological the attachment of the fifth transverse process to the ilium in certain types he described of stout heavily built people. People the opposite are the slender type of individuals who develop the possibilities of the gymnast and circus performer. I would like to know whether he regarded all these cases with attachment of the transverse process to the ilium as pathological.

DR ALBERT GOLDSPOHN About two years ago a nurse in training a stoutly built and healthy looking individual began to complain of hackache which radiated along the ilio-lumbar nerve on the right side chiefly. The trouble was sufficient to disable her and to necessitate rest in bed. I referred her to an X ray man who does good work and he was very positive in making out that there was an excessive length or an interfering deformity of the transverse processes of the fifth lumbar vertebra and was equally positive in suggesting surgery only to afford relief. I then looked up the past experience up to that time of surgery for this anomaly and found that in quite a number of cases operations had been followed by interference with nerves which resulted in lameness of the leg sometimes interference with motility or sensation and at other times both. In a number of instances these patients were confined to bed for a number of months before they

regained anything like their normal condition. I was rather surprised at these findings and thought I would try what local treatment along these nerve could do and began the hypodermic administration of iodine beginning with one quarter of a grain and carefully feeling my way upward until I gave fully one half grain in an aqueous solution twice a week and was encouraged in this by the diminution of the local pain which eventually disappeared and has not returned. That individual is under my observation now and is thoroughly well.

In this connection I might mention something which will avoid perplexity with some surgeons. It is not exactly in this line but more in a gynecological field. It has been my lot to treat two women who had the coccyx removed by good surgeons one of them my chief Professor Fenger because the coxalgia continued and was not benefited by the removal of the coccyx. In this matter I was helped by a German gynecologist that this backache in women is frequently not due to any anomaly in the bony structures but due chiefly to a varicose condition of veins on the inner side of the sacrum which have some capacity to make pressure upon the sacral nerves. The trouble was remedied as was done by the man who made the first explanation of the pathology by hydrotherapy in connection with internal massage.

Other similar backaches that have been through the hands of a number of men I have seen subside after curing a pronounced retroversion of the uterus not simply bringing the uterus into a normal position but by correction of the normal position by suspension of the uterus up against the abdominal wall by the right use of the round ligaments.

Dr SHACKLETON (closing). Anything which will impress upon the members of the society the fact that pressure upon the sacrolumbar cord will cause the symptoms I have mentioned is worth while.

In conversation with Dr Patrick not long ago he made the statement that he believed there was no such thing as essential lumbago that it was always due to some pathological condition. It would be impossible in a short time to call attention to all of the things that would cause this change so that I have dealt in my paper more particularly on the conditions at the lower end of the spine involving the sacrum and ilium and the lumbar vertebra.

Last fall one of our nurses came in with a severe backache and a roentgenogram showed both transverse processes impinging upon the ilium in such a manner that we could rotate the last lumbar vertebra on the sacrum itself. She had entered the Columbia University for the purpose of teaching school children

calisthenics and she complained bitterly that she had over exerted. She came to me three days before she went back to Columbia and I wanted the roentgenograms to show the doctor in New York.

In answer to Dr Harsha's question I believe both conditions occurred. In fact I have seen them occur. You may remember the fourth and last slide I showed where there was double articulation of the enlarged transverse process on both sides. On one side the transverse process united with the ilium as a true joint surface. On the other side the bones were grown together as if the periosteum had been scraped and a definite bony union occurred.

In regard to trouble following operation in 1916 I reviewed all the articles I could find of conditions involving the transverse process and at that time in all of the literature there have been reported only 10 cases of this condition 14 of which had been operated on. One man reported 3 cases and in 2 of his cases reoperation was required because not enough of the process had been removed at the first operation. Both cases were reoperated upon with relief following the second operation. I know personally two other cases which were operated upon both failures simply because the transverse process was not removed to relieve the pressure on the sacrolumbar cord. The danger of the operation seems to be injury to the sciatic nerve entirely. In the first case I operated on before I succeeded in stripping off the loose pieces of bone I had very decided response from pressure on the sciatic nerve. There was decided twitching of the leg and to obviate the pressure on the nerve I slipped a curved periosteal tom under the transverse process and had the assistant hold it up tightly while I chiseled off the transverse process with hammer and chisel. I can assure you it is not an easy operation. You are working down in a depth of three or three and a half or four inches and in a space about an inch and a half wide. You think you may be able to slip a Gigli saw around or take it off with bone biting forceps but I have never been able to do so. In all cases the transverse processes had to be removed by hammer and chisel. The only thing to guard against in the operation injury to the sciatic nerve which undoubtedly occurred in the case the doctor spoke of and which caused the after symptoms. In the fourth from the last case that occurred for a period of ten days following the operation the patient had considerable pain and discomfort and it was quite a little time before the patient was able to get around again. However the symptoms subsequently cleared up.

Dr Carl Beck discussed surgical reconstruction work during and after war.

# Surgery, Gynecology and Obstetrics

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 A J O h C h a r l H P k J R P g t S C P l m m r C h l s A P J p h R a n h f f  
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## GYNECOLOGY AND OBSTETRICS

A M E R I C A F k T A d w B o o k M A n p a h W E A h t n J M B a l d y C h a n g W B a r t t  
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 T h m S C l l E d w d P D v J p h B D L R b t L D k n W A N w m n D l a d E C  
 D u d l y H E h f t C S E l d P l m r F a n d l y H a y D F y G g G l l h m J R d d l e G o f f  
 S t h C G r d B t C H t J p h T J h H w d A K l l y A l b t F A K g F l o r i a n K r u g  
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 G e o g C M h H y p N w m G g H N b l C t a l E P d d k C h l B P n R b e n  
 P t n J o h O p i k W l l m M P i k C h l B R d E d w a d R y n o l d E m i R J h n A S m p n  
 F F S m p s o n R h d R S m t h W l l m S S t n H M S t o w W l l m E S t d d f d F r d n k J  
 T u s g H w a d C T y l H s m n V b g W F B W k f l d G o g G W r d J J W h t r d g  
 W l l m C A N A D A W W C h p m n W l l m G d n F W M l w K C M l l w t h B P W t  
 A H W g h t E N G L A N D R l l a d w T h m a W E d W E F t h g l l T B H l T h m  
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A M E R I C A W l l a m L B m W l l m T B l f l d J p h L B h m L W B r m e m a H g h C b t  
 J o h n R C u l k C h l H C h t w o o d J h n H C n g h m J F a R H g R b t H b t E d w d  
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## ORTHOPEDIC SURGERY

A M E R I C A E C A b b o t t N a t h I A l l W S B e G w l y m G D v i A l b t H F b g V g l  
 P G b y A r t h u J G l l t J I E G l d t h w t G W I r v g R b t W L o t t G g B P k d  
 W W P l m m J h n L P t J h n R d l E d w n W R y n H r y M S h r m a n D d S l H L  
 T y l r H A g u t u W l J m K Y u n g C A N A D A A M k n z F r b H b t P H G l l w y  
 C l a n L S t E N G L A N D S R b r t J A H T b b y G g A W g h t

## ROENTGENOLOGY

A M E R I C A E u g e W C l d w l l R l l D C m a n J T C L G g o r y C l e P t M  
 H k y H r y H u l t G g C J h s t n S d y L g e G g E P f b l H l l E P t t C A N A D A  
 S m l C u m m g A l d H w d P

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ENGLAND Ha ld Ch ppl H ld Cliff d F H L y W Fl tch Shaw Cliff d Wh t SCOT  
LAND H L th Murr y J H W llett

## GENITO URINARY SURGERY

AMERICA Cha l E B rnt tt J D B m y B S B r r ger H B n y J B C m nt tt Har y  
Cul Theod e D d wtz J S E nt t edr H A Fowl r F E Gard Lous G H G H m  
Th m C H ll w y I S K ll H A K u H m n L K t hm Vct D L p s William  
E L w r F ci M M C ll m H v v A M Stul g W Moorh d A N l k n C O C wley  
Edward A Ol e R F O N l H D O C D P k ll H W Pl gg meye H J Polk y Jaros v  
R dd S W Sh p G g G S mth A C S t k L L T n B o e k G J Th ma H W E W lther  
C I L w Wh l H McClur Y g ENGLAND J Sw ft J l y S d y G M d ald IRELAND  
A d ew Full t n Ad m A McCo n ll S S P ngl

## ORTHOPEDIC SURGERY

AMERICA Ch l A Andr w A C B chm y Geog I B m n G ge E Benn tt Ralph S  
B m Ll yd T B wn C H man B hl C C Ch tt t n W A Cl k R b r t B C fl d Al R  
C l m A th J D v F k D D k n L C Don lly F J Ga l n M S H d on Philip  
H fman C M J b S F J F C K d n F W L mb Phlp L wn Pa l B Magn s n J me  
R M t n Geog J M Ch y H W M yed g A h O R lly H W O r R b r t G Pa kard  
H A P g Rob t O R tt J W S e J hn J Sh A th Steandle Charl A S t e Pul p  
Sw tt H B Th m J m O Wall e J m T W t k n C E W lls H W W l D F r t P  
W ll d CANADA D O d n E n ENGLAND H w a d B k E Rock Cal g N ght n Dunn  
E L m g E an W H Hy T P M Murr y J h M l y Ch l R b t O D T l f d

## ROENTGENOLOGY

AMERICA D v d R B wn J hn G Burk Wll m Evan I a e G ber Amed Gang G W  
G Ad lph H tu g Arthu H ld g C B H ll g Leopold J h s Alb t M lle Edwa d H Sknn r  
D d C St u F E Turly J D Zul k

## SURGERY OF THE EYE

AMERICA E W Al and N M B nk h ff J Sh ld n Clak C G Darl g T J D m ty  
J B Ells E B Fowl Lewis J G ldb h H rry S G dl J Milton Gri c m D F t Harbrd  
Em y H ll Gut u I H gu S S H w E F Krug G Dvo k Th bald W lt W Wat o ENG  
LAND F J C n gh m M L H pbu n F te Mo SCOTLAND John Pe n Arthu H y H  
S l R ms y H T qu J me A W l

## SURGERY OF THE EAR

AMERICA H B att e B wn J R Fl t h A Spen K u fman R b t L Loughren Ott M Rott  
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## SURGERY OF THE NOSE THROAT AND MOUTH

AMERICA G ge M C t M N F d p l C I F ch J m J King R Clyd Lyn h Ell n  
J P terson H A Pott AUSTRALIA V Mun INDIA J hn T M phy

# INTERNATIONAL ABSTRACT OF SURGERY

DECEMBER 1918

## ABSTRACTS OF CURRENT LITERATURE

### GENERAL SURGERY—SURGICAL TECHNIQUE

#### ASEPTIC AND ANTISEPTIC SURGERY

Fraser F. and Others. Primary and Delayed Suture of Gunshot Wounds. A Report of Research Work at a Casualty Clearing Station. *Brit J Surg* 1918 1 92

This paper is a report of the research work on primary and delayed primary suture of gunshot wounds done at a casualty clearing station from December 7, 1917 to March 1, 1918 under the direction of Fraser. Included in the paper is a report on the bacteriology of wounds by Stokes and Tytler.

For the purposes of this work during the period mentioned only men suffering from wounds of the upper and lower limb were admitted to the casualty clearing station. Of these 60.8 per cent were entered on the research list as being cases suitable for immediate or early suture.

Patients suffering severely from shock and loss of blood who are not in a condition to bear a thorough cleansing operation and whose tissues have lost much of their normal power of resisting infection are not as a rule good subjects for primary suture. Patients who show signs of already established infection of the tissues surrounding the wound must also be rejected. These form a large class and include the majority of men whose arrival at the casualty clearing station has been delayed beyond twelve hours.

Wounds have been sutured without the aid of antiseptics and also with bipp, flavine and dichloramine T dissolved in chlorinated soft paraffin. The number of cases treated with these solutions is too small to warrant any positive conclusions regarding their value.

Every case excepting through and through wounds or contour wounds with no damage to bone is examined by X-ray before operation.

A specimen is taken from each wound for culture immediately before operation. The method used at the casualty clearing station could well be employed in civil practice. For this purpose a swab is used

contained in a glass tube in the upper end of which cotton wool is packed. The whole is placed in a test tube the mouth of which is also plugged with wool. The apparatus is sterilized in the autoclave and when the specimen is to be taken the inner glass tube with the swab is withdrawn and placed in contact with the wound. The swab is then thrust down into the depths of the track and thoroughly smeared on all parts of the wound which can be reached. It is then withdrawn into the tube and both are replaced in the test tube. This method was introduced by Stokes.

Previous to operation the patient's skin is shaved, washed with soap and water followed by spirit, then painted freely with a 5 per cent solution of picric acid in spirit.

The technique of operation is as follows. A very narrow margin of skin around the wound is excised in the form of an ellipse. Then the incisions are prolonged sufficiently to obtain a full exposure of the track. With the aid of good retractors the walls are removed with scissors or knife. All soiled dead or severely bruised muscles are snipped away until healthy contracting and bleeding tissue is exposed. As little healthy tissue as possible is removed. The fingers are not permitted to touch the tracks. Instruments are changed frequently or rinsed in 1:20 carbolic acid from time to time.

The operation is not complete until every part of the wound has been dealt with and every fragment of dead muscle removed. Important structures such as main vessels and nerve trunks which cannot be excised should be carefully cleaned with knife, scissors and swabs. The use of dyes such as 5 per cent solution of methylene blue or brilliant green in 10 per cent formalin which has been recommended strongly by the French surgeons is considered by the authors to be of some value in dealing with large wounds where small patches of dead tissue are apt to escape attention.

In the case of compound fractures the wound in the soft tissues is dealt with as above described and foreign bodies and loose fragments are lifted out and



1 Almost all pathogenic bacteria are capable of fermenting glucose some of them however much more slowly than others

2 During fermentation a definite acidity of the medium is produced

3 Many of the bacterial toxic bodies using the term in its widest sense are formed to the greatest advantage in a definitely alkaline medium and the production of these substances is in some cases distinctly inhibited by the presence of glucose diphtheria toxin is an instance in point

4 Foul discharges are in most cases due to the tryptic digestion of proteins and this is a form of enzyme action which can only go on to advantage in an alkaline substrate and which ceases in the presence of even a slight degree of acidity

In one case of bromidrosis it was as effective as in cases treated with glycerine

Ozema treated with a 25 per cent solution of liquid glucose has been cleared of the foul smell and incrustations concurrently The final results as to permanency of cure are to be reported later Glycerine gives better results

Chronic otorrhoea cases seem to have varying reports as to the results

Cases with chronic vaginal discharge were treated with douches of 25 per cent solution of liquid glucose twice a day or a glucose suppository (25 per cent with a gelatine basis) used nightly In most cases the purulent discharge rapidly diminished in some cases it cleared up completely and the vaginal secretions resumed their normal acid reaction He does not assert that the condition can be cured by this means

Two things admit of a positive statement (1) the patient's comfort has been increased by the diminution of the discharge (2) the normal acid reaction of the vagina has been restored

CARL R. STEINLE

### ANÆSTHETICS

Sweetnam H W An Experience of 50 Cases of Rectal Ether Anæsthesia *Med J Austral* a 1918 1 452

The author regards rectal ether anæsthesia as a very valuable method provided the proper technique can be obtained and a suitable dose given He regards it as being as safe as or even safer than the usual inhalation method and believes it to be applicable to all cases from three years upward and of especial value in all operations about the head and neck

In toxic goiter cases he advocates its use and suggests rehearsing for a week or more before operation every detail of the technique of administration since in this way the element of fear can be almost if not entirely eliminated

He also believes the method of special value when it is particularly desired that no vomiting should occur as in ventral or umbilical hernia and he considers it the method of choice in asthenic and bad

risk cases such as palliative gastrojejunostomy in advanced pyloric cancer

He believes the only contra indications to be (1) pathological conditions in the lower bowel (2) children under three years (3) cases requiring operations in the Trendelenburg position

The anæsthesia from a surgical point of view he regards as satisfactory in a majority of his cases and in many perfect although he has not been favorably impressed with this method in abdominal work as relaxation has not been altogether satisfactory

The general condition of the patient during operation has been in most instances thoroughly satisfactory and in only one case was shock of any severity noticed In this case the shock was directly the result of hemorrhage from a cystic artery in a woman aged 64 suffering from empyema of the gall bladder on whom a cholecystectomy was being performed

He has experienced no postoperative ill results In 24 of his cases there has been no vomiting or even nausea and this quite irrespective of the class of operations performed In 25 of the patients who vomited the sickness did not last more than three or four hours and the average number of times they vomited was four In one case only was there sickness as late as twelve hours H J VAN DEN BERG

Burger T O The Scope of Local Anæsthesia *Med & Surg* 1918 11 58

The author believes that not every operation is adapted to local anæsthesia not every patient is a suitable subject for it and not every surgeon is temperamentally fitted for it even though he attempts to master the art

A thorough and painstaking knowledge of anatomy especially of the sensory nerve distribution is an absolute requirement for a successful local anæsthesia also one should be familiar with those structures that are alive to certain trauma

The drug used is of primary importance Burger believes that procaine is a safe satisfactory and easily sterilized drug and that it should be employed whenever obtainable since it does not produce oedema delayed healing or invite infection

It is important that the armamentarium should be in perfect working order Children as a rule are not desirable subjects A nerve sedative the night before the operation may infrequently be necessary

The author is in the habit of giving one and a half hours before the time set for the operation a test dose of morphine and scopolamine hypodermically usually  $\frac{1}{8}$  and 1/200 gr then forty five minutes later he gives another dose of an amount indicated by the effect of the first hypodermic in the next forty five minutes the patient is carried carefully to the operating room in a psychically benumbed condition

Assurance is given that no pain is necessary during the operation but that the least sensation of pain is to be mentioned The patient is made as

comfortable as possible a drink of water or of fruit juice may be given at interval if desired. The surgeon should be preferably seated or at least in a comfortable position.

Burger emphasizes a conclusion some of the  
essential requisites

Use plenty of the anesthetic solution. Exercise extreme gentleness—never pulling or tearing the flaps.

Have the incision long enough to approach the work without cramping or necessitating much retraction.

Secure the patient's confidence and emphasize the fact that he or she is not to be a soldier or to be able to endure to get through the operation safely.

Last but not least the surgeon to be successful in this r<sup>k</sup> must be a near enthusiast if not entirely one.

E. C. ROBERTS

## SURGERY OF THE HEAD AND NECK

## HEAD

Hutlins J. The Operative Treatment of  
Trigeminal Neuralgia. L. (1911) 86

f pletif m n ual g a n l i the uper  
i n l nte r max l lary d i s i o n f the fifth  
nerv the only treat ent hich can affo d last ng  
cure c n i t s n pe ating on the gas erian ganglio  
Th uthor pas the phth lmic d i s i o n f the  
ne e n h s pe at ion l i e mploy t h t e mporal  
out w t h t e patient eated in a d n t l ba

[illegible]

Until the last month out of over 60 cases the  
with had no mortality. Recurrence in the spread  
ophthalmic trunk occurred in but one patient after  
ten years; this was completely relieved by re-  
section of the supraorbital nerve.

With the opening in the skull limited to the squamous portion and the skin incision concealed by the hair, also there is no subsequent deformity.

After the operation facial paralysis or paralysis of uncertain duration has occurred in a few cases on the side operated upon probably due to detachment of the dura from the upper surface of the petrous bone and blood getting through the small openings leading to the aqueduct of the fallopian

In three or four cases there has been weakness of the opposite arm and leg apparently from

ret actor pressure on the brain during the operation. Recovery from this is slow. Sometimes the result is disappointing, as the patient has after years of suffering and repeated failure of injections become a confirmed neurotic. With the complete freedom from pain and the ability to masticate solid food the patient gains weight and color remarkably.

Alcohol injection is but an indifferent substitute for the perianthion on the gasserian ganglion. However, when the patient wishes it and fears the major operation, a careful trial of alcohol injections should be made if the fails, excision of the gasserian ganglion should not be deferred. V. C. Hunt

Wollst. in M. An F p. imental Study of Parotitis  
J. im M. 1 0 8 1 630

Cat in whom the parotid gland and testicle have been injected with a bacterial sterile filtrate of the salivary secretion of children and adults in the active stage of parotitis of mumps develop a pathological condition resembling the condition present in humans in human beings.

After an incubation stage of from five to eight days definite changes have been noted in the temperature of the leucocyte and inoculated organs. The rise of temperature and the leucocytosis precede the glandular swelling but all the changes reach the maximum at about the same time after which they decline and in normal conditions reestablished in about four weeks.

The intraparotid and intratectal injections of the tracts of normal parotid gland and testis may cause a mild rise of temperature and leucocytosis of brief duration but swelling and tenderness are absent. The histological changes are the polymorphonuclear and not the lymphocytes. The injection of filtrates of normal saliva cause only a mild and brief rise of temperature but no leucocytosis nor swelling of the glands.

The saliva of man and of inoculated cats as well as the inoculated gland of the latter animals were found to contain the filterable infective agent.

The virus of parotitis is most easily detected in the saliva during the first three days of the disease. It is shed on the sixth day and not at all after the ninth day. This would have a practical bearing on the question of infectivity and length of isolation period for mumps patients.

The virus was also detected in the blood of patients showing marked constitutional symptoms.

The serum of recovered cats was found to contain an immune body which diminished or even neutralized the action of the virus of parotitis.

EDWARD L. CORNELL

**Winslow J R** Report of Some Cases Mostly Traumatic of Serious Damage to the Nose and Accessory Sinuses Operated upon Externally with Excellent Cosmetic Results  
*Tr Am Laryngol Ass Atlantic City 1918 May*

The author reports a number of cases of operative cure after serious injury to the face.

Case 1 was an extensive traumatism of the nose face and frontal sinuses due to a fall from a height. Operative cure gave an exceptional result.

Case 2 was that of a frontal empyema with extensive bone necrosis and external fistula operated upon externally in several sittings. Cure of the condition was obtained with an excellent cosmetic result. Several interesting points were presented by this case.

1. Intranasal pathologic conditions were absent. A virulent infection seemed to have attacked the frontal sinus and uppermost portion of the bony framework of the nose without involvement of other nasal sinuses.

2. The posterior cerebral sinus wall was denuded but was hard and seemed devitalized rather than necrotic. It took 26 months for it to regenerate but the author's judgment and the advice of colleagues was that it was better to delay than to assume the risk of removal.

3. There was marked anesthesia of the operative field the packing being for a long time painless doubtless due to the devitalized bone.

4. Excellent cosmetic results were obtained. Case 3 was a fracture of the external bony framework of the nose and the nasal septum by the kick of a mule causing a depression of the tip of the nose and great disfigurement. Restoration of appearance and function was obtained by operation.

Case 4 was a fracture of the right nasal bone and nasal process and a portion of the orbital process by an iron rod followed by the formation of sequestra and an abscess with secondary infection of the right antrum. Operation brought about a cure with a good cosmetic result. Photographs showing the excellent results were presented. **Otto M. Ross**

**Schachner A** A Practical Consideration of Cerebral Decompression  
*1st J Surg 1918 xxxv 198*

Cases requiring cerebral decompression fall into two major classes: (1) all conditions which slowly but progressively encroach upon the intracranial space such as cerebral tumors alone or cerebral tumors plus internal hydrocephalus through occlusion of the Sylvian aqueduct or external hydrocephalus occasioned by diminished absorption through the subarachnoid space and (2) those conditions in which

there is a rapid and progressive encroachment upon the intracranial space plus destructive lesions to some parts of the brain the causative factor in this class being trauma.

A third class is also mentioned namely the idiopathic type of epilepsy.

In the application of decompressive measures in cases of the first class the aim should be to afford the greatest relief possible from the increasing intracranial tension with the least interference with the nerve tracts. In the second class where the progression of symptoms is more rapid and the underlying trauma has occasioned lesions in the brain it requires a careful study of the case to correctly interpret the rapidly changing conditions.

A gradual and progressive rise in the blood pressure and a gradual and progressive decrease in the pulse in head injuries call for a subtemporal decompression even though the eye does not offer evidence of papilledema. Congestion of the retinal vessels and slight pinkish color of the discs are common attendants of head injuries and in themselves do not call for a decompression unless the changes are progressive.

Proper decompression in carefully selected cases not only affords the greatest measure of success so far as recovery is concerned but safeguards the patient to a considerable extent against subsequent neuroses common to head injuries. **E. B. Freilich**

**Keen W W and Ellis A G** Removal of Brain Tumor Report of a Case in Which the Patient Survived for More than Thirty Years  
*J Am Med Ass 1918 xlv 1993*

Keen gives a somewhat lengthy summary of the case because it was his first modern brain tumor case because it shows the technique at that time because it was one of the earliest operations on such a tumor following by only two years the very first performed by Godlee in 1885 and because of the great length of time between the operation and the death of the patient.

He regarded as of special pathologic interest the extensive exposure of the interior of the left ventricle for a period of thirty years. The ventricular area of the central nervous system was greatly increased but so far as the clinical history of the case indicated there was no symptomatology of changed intracranial pressure either increase or decrease. He regarded the fact that the covering of the wound was depressed when the patient was in the erect posture as evidence that the pressure was increased to no apparent extent if at all. He believes that when the patient stooped and the scalp protruded the spinal fluid must have accumulated principally in the left lateral ventricle area. At necropsy there appeared to be no increased amount of fluid and the depression of the scalp during life he believes a proof that the wound cavity was not filled by that fluid.

He considered the question as to whether the inner surface of the wound became covered by ependyma extending from the ventricle but this was proved

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## SURGERY OF THE HEAD AND NECK

### HEAD

Hut l ns n J The Op at e T tment of T g m n l Neur lg L f L l ) 8

F r p leptif rm neu alg n ling th uper a i niero maxil y div n f the ifl nerv the lv tre tment v h b can ff d la ting cu e n sts in pe tung n the g ang nlon l the uth pae tle phib l c d n of th ner n hu pe at n He mply the temp l ut ith the pat nt seated n a de t l hair

The fl p ith t ba eat th zyg n i j ov d f mall n i e a d kept holly th n the hairy c l p The d a det hed and the per t r v k n ard to a dth for me o le h hle oppo ite t th pre l noid tulercl n l the l a nen sp no um hich le ab ut n m behind and a little ternal to the t i th infer r navillary ne e Th oddl n geal r v t d and di d d The dura f th aied until th g gl n th t upe i r nd i f r maxil ry banche s exp d Th latt r b n b s cle l s f o ard the f a en tunlum The gangl n em ed ith three line of e tio s o e ut di iding tle l e maxilla y d i n at th f amen l n the the uper or maxil ry t the f men rotundu a d the th d p sng h ri t lly l l the ophthalm d i i hich pa ed T s rill d ainge tules r left i th o nd d the fl p uured ith t epl em nt f l n

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In the e or f u cases there ha been w kness f the oppo te arm a d leg apparently from

retra to pre ure on the brain dur ng the ope ation R co ery fr n thi slow Sometimes the result i l p ppoint g as the patient has after years of suffering d repeated failure of injections bec me a l med neu otic With the complete freedom f om p n nd the ability t masticate solid food tb patient g n eight and v r remarkably

M h l njecti n i but an indifferent substitute f r the ope r tion on the gasser an ganglion Hov er hen the p t ent v i he it and fears the m jor pe ti n a c eful trial of alc hol njections should be made if this f ls e cision of the gasserian gang l no ld not be defer e l V C Huvr

W ll te n M An T pe im nt l Study of Pa otit s J f l f f 9 8 l 639

Cats n h m the parot d gland and te ticle ha e been injected with ba terial sterile filtrate of the alivary s creti n oi child n and adults n the act e stage f parot t f mumps develop a path logi cond tion res mbling the cond t on present in mumps in human bei g

After an incubat on stage f from fve to eght days defnite changes ha e been noted in the tempe ature bl od leucocyte and inoculated orga s The rise f temperature and the leucocyte p e cele the gla dula swell g but ill the chan es r ch the ma imum t about the same time after hich th y decline and l nrmal cond tions are re e t bl he l n about f ur eeks

The intr parotid nd intrateat cular njecti ns of extracts of r mral parotid gland and testis may cause a mld ise of temperature and leucocyte of b ief du ation but ell g and tenderne s are bsent The hite cells ncreased are the polymor ph nuclea s and not the lympho yte The i jec tion i filtrat s or normal saliva cau e only a mld brief rise of temperature but n leuc cyt si n r s vll g of the gl nd

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microscopically not to be the case. He believes that if as is generally believed the fluid is very largely the product of choroid plexus the condition obtaining here would be of more importance from the standpoint of pressure than from product on of fluid and regards his case as one of long standing increase of ventricular capacity without demonstrable clinical effect.

H. J. VAN EN BERG

**L. is F. P. Hypophysis Cereb. and Its Morphological Influence.** *L. yng c p 98 vi 64*

The author formulates the principle that the hypophysis cerebri when normally functioning exercises controlling influence not only over the skeletal and muscular structure but over the nutrition and development as well of all tissues having an embryonic and mesoblastic origin.

He traces the effect of hyperpituitarism and hypopituitarism on body structures. One portion of the pituitary may show signs of increased activity and on the part on diminished activity. These effects should be noted in the eye as well as other body structures. He cites two cases.

I. E. B. SHAW

**Fracass. I. Syphilitic Diabetes Insipidus (Da).**  
b t p d ult ) R t d d Ro  
98 9

Syphilitic diabetes insipidus was known to Fourrier in 1811 and he considered it dependent on a syphilitic cerebral condition which injured the fourth ventricle. The subject has since been frequently mentioned in literature.

The author reviews the later developments connecting diabetes insipidus with hypo- or hyperfunctioning of the hypophysis. He thinks it is now recognized that all forms of diabetes insipidus have a common origin due to a functional or organic disturbance of the hypophysis or of the cerebral polyuric centers.

In cases of syphilitic diabetes insipidus the spirochete may attack the hypophysis producing gummatous or terial lesions but as a general rule it produces gummatous or sclerogummatous meningitis of the base of the brain which is the location of choice of the microbe in this region. The meningeal process directly attacks the polyuric centers or act upon the hypophysis according to which the view of the pathogenesis of diabetes is accepted.

The author gives the clinical details of a case of syphilitic diabetes insipidus in a man twenty-five years old. The symptoms yielded under mercuric injections.

W. A. BRENNAN

## NECK

**Aikins W. H. B. Radical Therapy in Hyperthyroidism with Observations on the Endocrinous System.** *C d P i & R 98 xl 35*

The author states that he has had 45 cases under treatment of these 3 have been clinically cured

the tachycardia tremor and restlessness have disappeared and symptoms of excessive thyroid secretion have abated. In 17 cases there has been an improvement but not a complete cessation of symptoms. Four cases have passed from observation. In only 10 patients did the thyroid gland itself decrease in size while in 6 cases the effect was no reduction in size although the nervous symptoms were completely relieved. In 3 cases thyroidectomy had been performed but the nervous symptoms had not diminished. Thus as has never effected by radium.

In connection with the treatment of these cases general medical measures were carried out as well. Physical and mental rest a low protein diet quinine hydrobromate 5 gr t i d together with ergot n i g r t i d was prescribed.

In a large number of cases all these usual medical measures had failed to relieve the symptoms and it was only when radium therapy was added that the hyperthyroidism was lessened.

The author reviews the subject of the endocrine glands and quotes largely from Blair Bell.

L. H. LANDRY

**Jann y N. W. and Isaacson A. I. The Influence of Thyroidectomy and Thyroid Disease on Protein Metabolites.** *J ch i i Med 98 174*

The endocrine glands undoubtedly play an important role in controlling metabolic processes. This field fascinatingly invites research study both on account of its high scientific interest and its clinical importance. For some time past the authors have investigated the influence of the thyroid gland on metabolism. The problems investigated have comprehended the relation of the thyroid to (1) carbohydrate metabolism (2) protein metabolism and (3) thyroid therapy.

In the present article the influence of the thyroid on certain aspects of protein metabolism is considered. Although it has been known for a long time that the administration of thyroid preparation stimulates protein catabolism and conversely that the ablation of thyroid function diminishes tissue breakdown still knowledge of the influence of the thyroid on specific nitrogen metabolites such as ammonia creatinin and the purines has remained rudimentary. Better information is very desirable so if one could for example trace the control of creatinin and purine metabolism to the thyroid or other ductless glands the curtain obscuring our understanding of the causes of various myopathies and endogenous diatheses might be raised.

A study of the thyroid taken as a type of the endocrine organ on the nitrogen metabolism is therefore of considerable importance. This problem has been attacked from two chief directions. First they endeavored to learn more about thyroid function by estimating the nitrogenous constituents in the urine of animal before thyroidectomy and then

observing the changes occurring after the operation that is the metabolism of experimental athyroidism. Second the metabolism of experimental hyperthyroidism was studied by following the chemical urinary changes after injecting in overdose of the isolated thyroid hormone. Third supplemental studies were made in cretinism and exophthalmic goiter as types of hypothyroidism and hyperthyroidism.

As a result of these experiments the authors reached the following conclusions:

No selective action of the thyroid was observed on urea and ammonia. The percentages of these substances remained within normal limits. The amounts varied with the total nitrogen in the usual manner. The experimental studies definitely demonstrate that the thyroid exerts an influence on purine metabolism as observations showed a decrease in the urinary purines after thyroidectomy and a marked increase in experimental hyperthyroidism also a tendency to a low purine excretion in the cretin and a high excretion in the case of exophthalmic goiter. The clinical observations thus tend to confirm the experimental findings but should be extended before conclusions are justified.

The behavior of the purine metabolism in hypophyseal disease seems to be analogous to that in thyroid disease. In the few cases investigated the endogenous purine excretion is reported high in acromegaly by Falta and Nowaczynski. The same investigators found a decreased uric acid elimination in hypopituitarism (Frohlich's syndrome). The observation that the thyroid exerts an influence over purine metabolism analogous to the effect of the hypophysis is important and further illustrates the fact which is becoming more and more apparent namely that several of the endocrine organs may exert very similar influences on the metabolic processes.

With regard to clinical applications it might seem in view of these results justifiable to seek the cause of gout in an endocrine disturbance. So far however as the thyroid and hypophysis are concerned clinical observations do not support a relation of diseases of the e organs to gout. One might likewise feel inclined to administer thyroid or pituitary tablets to gouty patients in the hope of stimulating the excretion of the purines. According to the authors' views however this would scarcely be advisable at least in the case of thyroid for it is probable that the excretion of purines is increased only as the result of a toxic effect of large doses of thyroid on the protein of the tissues.

Their studies emphasize the independence of the creatinin metabolism from thyroid influence. Creatinin was not increased in the urine even when large amounts of body tissue were being broken down in experimental hyperthyroidism. This would seem to indicate that creatinin is not a direct product of protein catabolism. With regard to creatin it is indeed strange that a product which is chemically merely hydrated creatinin should appear

in the urine while the creatinin undergoes but little change. This apparent independence of creatin from creatinin metabolism is striking. A number of previous observations have however shown this to occur under other circumstances.

In the thyroidectomy experiments the creatin determinations are not very valuable as this substance is usually present in normal dog urine. However the fact that it is found in cretinism and exophthalmic goiter deserves consideration. Creatin is usually excreted when masses of body tissue are being broken down such as takes place in severe febrile conditions. Such is however not the case in cretinism. Its appearance in this condition is probably due to a disturbance in the normal synthetic metabolic processes which take place by means of intermediary chemical reactions which are yet little understood but may be disturbances in the metabolism of carbohydrates. The creatinuria of exophthalmic goiter seems more easy of comprehension than that of cretinism for in exophthalmic goiter there is frequently a toxin breakdown of body tissue which may be held to account for the appearance of creatin.

The present experiments do not support the view that any marked diminution of nitrogen excretion follows thyroidectomy in animal. Nor was the nitrogen output particularly low in the cretin. There are moreover reasons to believe that the decrease in the protein breakdown observed by others in the cretin metabolism is due rather to an inability for growth and repair of tissue to take place. These views will be more fully developed in the next article of this series. GEORGE E. BEILBY.

Herniman Johnson F. The Use of X Rays and Electricity in Exophthalmic Goiter and Other Disorders of the Ductless Glands. *Arch Pediatr & Electroltherap* 1918 xxi 9.

The author maintains that the roentgen ray applied in small doses at frequent intervals has a regulating action upon the quantity and quality of the thyroid secretion. This renders it of great aid in the treatment of exophthalmic goiter especially in the early stages of that disease although beneficial in most cases at any period of its course. The pulse rate slows down the tremors and sweatings diminish and sleep improves. Visible pulsation in the neck disappears the gland if enlarged diminishes in size to a variable degree but the exophthalmos is but little reduced. Practically all that can be done can be accomplished in three months.

In addition to the roentgen ray the author has used a combination of electrical remedies with advantage in a number of cases. A rhythmically interrupted sinusoidal current applied to the cervical region frequently tends to lower the pulse rate when it is refractory to roentgen rays alone. Galvanism applied to the gland may materially reduce the size of the gland. The exophthalmos also is favorably influenced by the above measures. Cerebral galvanism employed when the nervous unrest is very

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## SURGERY OF THE CHEST

### CHEST WALL AND BREAST

R illois H nd Cull m L u l Pr m y  
Op at on n Cl t Wo nd A t p d  
B l l t l d l d P l o s l 48  
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l f c r l p r t i n n und l the t n t  
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l g t t d l y n th e f c l e l u n l  
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t l p p t l l l t v f l l n  
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t l th t h qu f l  
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t l d l l p l t f th t n r s f  
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t th t t t h t h l th u l m l al  
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t u l i the d u t f the p j e t l t a  
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u u b  
I th pe ted upon by the auth r  
t i r e c a d e ths Th u d n v s e i u  
e d th d th u l d t n a n y y h  
t t but d t the p t n but w e the n s p t e  
f t W A B

Norri R C Th P e nt on of Mast t s l J  
Ob t l l q s l 46

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br a t p r p e ly h r h is the p e c n t i o n of h e a s t

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f t h h l m s t l y h o l d h a v e b e e n  
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3 D v a d m o t h e a t a n d p r e s s u r e p o p e l y  
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C R E C l l a t v

V s c l c o t z A V T l T r e a t m e n t of D e r i s e s f  
l t h C o s t a l C a r t i l a g e i S g P l l 9 8  
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The a u t h o r g e a o m e w h t d e t a i l e d a c c o u n t of  
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b y a n n f the l p d u c n g g r m s

T h i n f e t s c a s e d m t f r e q u e n t l y b y the  
t b e r l b c l l e t n f r e q u e n c y a p p e a s t o b e  
the t y p h o d h a c l l s

3 C r t l a g e p o s e d n a n i n f e c t e d o u n d d o e s  
n t h e l a d p r c t c a l l y a l a y s f o m a s i n u s

4 G n the s a m e c o n d i t i o n s i e e p o e d  
a t l g e p l u s i n f e c t i o n a r e l a p e i l m t c e r t a i n t o  
o c u r e n i f a p o t i o n of the d e e d c a r t i l a g e h a s  
b e e n e i d a p p a e t l y w e l l b e y n d the i f e c t e d  
a e

I f the c o n d i t i o n s a r e f a v o r a b l i e i n the  
a b s e c e of r i t h o n l y v e r y s l g h t i n f e c t i o n the

operating surgeon may take the risk and close the wound entirely under no circumstance should a wound of this nature be drained and lest of all with gauze

6 The most certain procedure is to remove the offending cartilages throughout their entire extent so that not even a trace of exposed cartilage is visible in the wound. If any portion of the sixth seventh eighth ninth or tenth costal cartilages are diseased it is necessary to remove all the cartilages *in toto* in order to bring about healing

H J VAN DEN BERG

Meyer W Postoperative Thoracic Drainage *Ann Surg* 1918 LVIII 56

The author after a somewhat exhaustive review of this subject gives the following conclusions

1 Thoracic operations the same as operations in other parts of the body often demand drainage

2 With no adhesions present between the two pleural leaves an acute postoperative pneumothorax is the inevitable consequence if an ordinary drum rubber cigarette or gauze is introduced. The occurrence of a complete pneumothorax after operation greatly enhances the dangers confronting the patient during the after treatment

3 It is therefore necessary to avoid this complication. This could hitherto be accomplished either by leaving the patient under the influence of differential air pressure for a greater period of the first twenty four hours following the operation after having closed the thoracic wound and then covered the drain ends outside with a large piece of rubber dam or by making use of Fiegel's thoracic metal drain. Both methods have been tried and found satisfactory both however for the question here under discussion have certain drawbacks

4 Kenyon's method of postoperative drainage fulfills Sauerbach's demand that the thorax be closed air and water tight after intrathoracic operations. Yet it permits of draining off in an efficient manner the secretions of the pleura which follow the majority of intrathoracic operations and usually are not sterile. Kenyon's method is described as follows

After proper local preparation the aspirating needle proves the presence and location of the pus. It is left in place. Alongside the same a narrow bladed knife is inserted between it and the upper margin of the rib below until it penetrates the pleural cavity. A short incision is made the knife with drawn and replaced by an artery clamp. After removal of the needle the branches of the clamp are spread and the drainage tube crowded in. It passes through a button holed piece of tape which is fastened to the chest wall with adhesive plaster and prevents its slipping out while a rubber cuff over the tube takes care of its not slipping in farther. The end of the tube is connected with a bottle underneath the bed the same as when draining other cavities of the body

5 The introduction of Kenyon's method of drainage therefore bids fair to mean a long step forward in the evolution of thoracic surgery. It greatly adds to the safety of intrathoracic surgical work and should for the present at least be employed after every operation upon the thorax in which the free pleural cavity particularly a virgin pleura had to be transversed

Summarizing the author believes that at the present moment the successful issue of surgical work within the thorax seems best assured by combining immediate complete closure of the incision with an efficient method of simple and safe drainage of fluid and air without allowing the latter to reaccumulate into the chest

H J VAN DEN BERG

Rinehart S M and Oelgoetz A W The Treatment of Empyema by Frequent Aspiration and the Injection of a Solution of Formaldehyde and Glycerine *J Am M Ass* 1918 9:18 1 1 274

At Camp Sherman a series of cases of pleural effusion aspiration of fluid was performed as soon as diagnosed without waiting for symptoms of sepsis. The aspiration was immediately followed by an injection of per cent formalin solution in glycerine. Further aspiration and injection was done as soon as fluid reaccumulated

A large caliber needle was used and no untoward effects occurred. By this method the authors claim patients get well more quickly than by thoracotomy or rib resection. They think the method should be tried first and rib resection can be done later if indicated. Protocols of pus aspirated and bacterial counts in two cases are included

C A HILBLOM

## TRACHEA AND LUNGS

Roy D A Carpet Tack in the Right Bronchial Tube of a Patient for Two Years with No Pathologic Symptoms. Exhibition of Plates *Tr in Laryngol* 1918 Atlantic City 1918 May

This occurred in a woman aged twenty eight years. X ray showed the tack in the right bronchus between the seventh and eighth ribs. Its removal was at once attempted by upper bronchoscopy and failed. Tracheotomy was performed the next day the bronchoscope passed but it was impossible to grasp and dislodge the tack. The tracheotomy wound was allowed to heal

Five months later a bronchoscope was easily introduced by upper bronchoscopy. The tube was too short and the foreign body could not be removed

The patient has been entirely well and has increased in weight since that time two years having now elapsed. X ray photographs show the tack still *in situ*

The author presents records of a number of cases of this character many of them producing no untoward symptoms

Otto M Rott

Petit de la Villeon Posterior Thoracopneumotomy  
Under the R di pic Screen for E traction  
of Projectiles f m tl Region of the Hilum of  
the Lung (L th p m t m p té  
do p i po i t t e d p j t l  
i d l é g h l d p m ) B ll t  
mém S d h g d P 9 8 1 976

Petit de la Villeon has extracted 16 project les  
from the h lu eg f the l ng vith suc e n  
all ca e pc at ngund d e p c creen cont l  
to v i all ng bl ope at e r umati m  
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of a e to th hl U der radi scop c tr l  
he o e ate th u g l o be i the scapul  
d p n Fle pe at n done t ee tige  
l n th c p l v r t c b r a l space only ther h ch hars  
tle l t t l e p j e c t l resected the th  
se nth ghth cc d g t the c e th  
re t i o e ten le l to make a h s t o  
l g th p t e i r t l a Th p l n t  
e d d l t i l l t e d n t l o ngle  
d p l i ut l Th p t a l p l a s o p n e d  
l l y u n l g l u a l t t l p m th r a re ults  
The l n g e p e l h d n full r ge  
r d r d l g l t In the c n l t a g e f p r t i n  
t l p j t l e l t e l by the \ a y l d  
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e t f th p t d f l l d a y l g h t  
In h 6 l t t d l l l e n has h a l n o  
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a i d s h e m o s t a s i s

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t i z i n g m l b l t c u e p l e r a l i n f e t i n and  
l a i g e f a l t e t g d T l e p t e i  
r t e u l d o c p y e m e r y a y p r e f e r  
b l e W A B r

H l m e s G W A C a f M u l t p l e A b s c s e s f  
the Lung w l Spontaneous Cur t m J  
R t g l 9 8 344

A f l l r e d f i l s e b t h l i c l l y a l  
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t k l l s n h c h t h y a p t m e c t h e  
f a c i e c h e t n f c a p l a t e l t h h e t  
n O t b e r o e l e i a n e f i r e e l  
d e n t y the u p p r i g h t T h e n m t l n g  
i n t h a f e e d d e n t y h u t t b l n e a r  
m a r k i n g t o t h b l e r e a c e n t u a d A t  
t h i s t m e t h e p a t t s h o e d j a c t u a l l y n p h y c a l  
s i g n s

A p l a t e m a d s x d a y s l a t e O t b e r 6 a f t e r  
t h e p a t i e t h d r s l a o n d e r b l a n u n t f  
s p u t u m s l o w e d t h a e f i n c r e s e d d e n t y  
l s e d i n a m u n t a l t e c e n t e r o f t h e a r e a  
s b o n g l e s s e n e d d e n t y h u c h s u g g e s t e d c a t y  
f o m a t i o n A t t h i s t m p h y s c a l f i n d i n g e e  
s t l l s i g h t

A p l a t e o n N o m b e r 6 h o d t h e p p e r r i g h t  
p t h o l o g y l a r g e l y d p p e a r e d b u t a e r e a o f

i n v o l v e m e n t o n t h e s a m e s i d e b e t w e e n t h e t h d  
a n d f o u r t h b n f r o n t T h e l u n g m a r k i n g t o t h e  
h u l u f o m t h u s r e e r e a c c e n t u a t e d a i n t h e  
c a s e o f t h e m a k i n g f o m t h e o r i g i n a l f o c u i n t h e  
u p p e r b e t N e m b e r 2 t h e s e c o n d a r e a s h o w e d  
a c c e n t u a t i o n h i l e t h e f i r t a r e a r e n t l y c l e a e d  
u p

N o v m b e r 2 f o l l o n g t h e l a s t p l a t e t h e p a t i e n t  
h a d a f e l g f o m e t h i n g g a n g a y i n h i s c h e s t  
f l l i n g w h h h e c u g h e l u p t o o u n c e s f f u l  
p u r u l e n t m a t e l T h l t p l e t h o e d t h e  
c d r a o f l e n s t y m u c h l e i n e t e n t a s i n  
t h a s i f t h e r i g i n a l f o c u t h e e a s a s u g g e s t i o n  
f c a i t y f m t n O n D e c e m b e r 3 t h e e c d  
p r c e h d p r t c a l l y c l r d u p

T h e d g n i s a s m u l t p l e a b c e o f t h e l u n g  
W A E

## HEART AND VASCULAR SYSTEM

D u a l P a n d B a r n s b y H A B u l l e t M o v a b l e i n  
t h P l e a d l S g m e n t o f t h e L o w e r V e n a  
C a a L t c t o n h y P r i c a r d o t o m y a n d I n  
c l o s o n o f t h V e n a C a v a ( B l l d f l m b l  
d l g m t p e d l d l  
t e t t p p e n d t m t  
d l ) B l l t d S d l d P  
9 8 1 38

I n a l d i e h o h a d b e e n s h i t i n t h e v i l l a r y l i n e  
a t t h e e v t h l f t r b d o l g i c e a m a n a t i o n  
h o d t h e b u l l e t f e l y m b l e n t h e r e g n o f t h e  
h e a t d i n f e r i o r e n a c a a S i n c e t h e r a a l e f t  
h e m o t h a n d t h e b u l l t w a t e a t t h e h t s d o f  
t h e s t u m i t s e m e d r y u n d a b l e t o p n t h e  
l e f t p l u M r e e t h e p o b a b i l i t y o f h a i n g t o  
p e t n t h e v e n a c a m a d e t d e a b l e t o h a v e  
a e s s t h l e r e g n

D u a l o p a t e l a s i t d b y B r n s b y a n d a n e  
t e c h n i q u e m p l y e d A c t a l m l i a n p e t e r  
n i c i n o n m a d f m t h f u t h i b t o t h e  
m d d l e f t h e u m b l i c a s t n o e p i g a s t i m c i o n  
D i t c h u n g t h e l l f a i m t h e p h o i d t h e h n g e r  
g l d e s t o t h e p t e i r f e o f t h e t e n m a n d a s  
c a n d a f a p s i b l e d e t h n g t h e b e n e f o m t h e  
p r e d u m a n d t h o p l e u a l u d e a c T h e  
s t e r m t h n s p i t a l n t h e m d d l l i n e f o m b e  
l w u p t h c h e l s f a a s t h e f u t h b t h e n i n  
t h e f u t h p c o s c i s a t t h e s t e n u m t a n  
r e s l y t h t t i s e t l y d v d d b y f n c s i o n  
t t o p r e t h y m o b l b l e f l p

A t c t r i t h a p p l e d l t i q u e t u n e c a r y  
t f c t u r e t h b t f l d t h e f l a p s b c k t h e  
e l a t i c t y f i t h a r t i l g e i s s f f i c i e n t T h e h l e  
s p a p e l l b k T h e p c e d i m a n d t h e  
p l e u r l a a n e s i l y b e d t a l e d t l o u t o p e n i n g  
t h m W i t h a f e m n e u e t h e o p e a t g t e l d i s s o  
h g e d t h t t h e t o h a n d e l y l k o t h e  
h e a t a s t n e i n g t h p r e d u m l n g t h m d d l e  
l i n e T h o a o b d m n l i n c i o n g i v e s n e x t  
t a d r y a m o u n t o f l i g h t t s p a e s t h e p l e u r a l  
s c e p o e t h e h e r t t h e l r g s s l a n d t h e  
h s e o f t h h r t a n d g v e a m i n u m f p e t e  
m u t l a t n

In the case under operation after a number of radioscopic attempts to locate the projectile it was finally found to be in the vena cava but constantly moving owing to the force of the blood stream. It was finally excluded in an auricular fold the extremity of the vein. A few purse string sutures were made around it and the sac thus made incised. This was at the juncture of the vena cava and the auricle and rather on the vein. The bullet was extracted. There was only a slight loss of blood. The sutures held quite staunch and the operative wounds were closed. During the maneuvers the heart continued to beat without manifest disturbance the rate being 104 at the end of the operation. The whole operation lasted thirty five minutes. The patient was up the ninth day after operation.

The authors draw attention to the fact that the projectile was movable in the vena cava migrating between the suprahepatic veins and the right auricle. It had perforated the left ventricle the intraventricular partition passed through the auriculoventricular orifice and reached the vena cava. It is the first case the authors believe in which a projectile was movable in this vessel and in the heart. It was kept in equilibrium by the force of the venous flow like an egg supported by a jet of water.

The authors also draw attention to the excellent results obtained by thoracotomy as a route of approach to the heart. W. A. BRENNAN.

### PHARYNX AND OESOPHAGUS

Judd E. S. Oesophageal Diverticula. *Surg. Gynec. & Obst.* 1918, LVIII, 135.

Judd differentiates between dilatations and diverticula in that the former involve all of the structure of the oesophagus while the diverticula are only in reality hernia involving the mucous membrane and submucosa which project through the muscular coats.

He divides diverticula into two types traction and pressure diverticula. In traction diverticula the distortion is due to a pulling force acting from the outside of the oesophagus and generally occurs at a point where the oesophagus crosses the left bronchus. Most often it is due to the contractions of a crura formed by the healing of a suppurating lymph gland.

Diseases of the pleura and lung adhesions of the thyroid when there is marked cystic degeneration mediastinitis and caries of the vertebrae have all been cited as etiologic factors in producing this form of diverticula. The diverticula are often multiple.

Traction diverticula usually produce no symptoms and have no surgical importance according to the author. Usually in these the apex is higher than the base so that food particles or mucus can accumulate however in those cases in which the apex has been so low as to allow accumulations of food particles the traction pulsion diverticula sometimes attain to a considerable size usually even then without presenting symptoms.

At the present time pulsion or pressure diverticula can be readily and accurately diagnosed and are am-

enable to surgical treatment. These diverticula are always located in the cervical region in the unsupported oesophageal wall and at a point directly opposite the cricoid cartilage this being the weak point in the arrangement of the musculature at the junction of the pharynx with the oesophagus. There is a physiologic narrowing at the level of the constrictor muscle and a hiatus exists in the longitudinal muscle. In most of Judd's cases this opening was posterior and the sac was usually present on the left side. The etiologic factor in these pressure diverticula has never been definitely shown but it has been shown that the pressure in the oesophagus was greatly increased during deglutition.

The first symptoms of this condition are usually dryness of the throat and a scratchy feeling as though a small foreign body were present these sensations make it difficult for a person to swallow. Nausea follows mucus is raised from the throat and later particles of undigested food are brought up. Difficulty in swallowing was noted in all of Judd's cases while 30 out of the 35 patients complained of regurgitation of food. A gurgling noise in the throat was present in 12 of his cases. A feeling of pressure symptoms of stricture and choking sensations develop.

Symptoms of an oesophageal diverticulum rarely present themselves before the patient is forty five years of age. The average age in this series of 35 patients when they came for treatment was fifty four years the average duration of symptoms was five and a half years.

A visible palpable tumor of the neck occurs only when the sac is large and in the cases formerly reported this occurred in about 30 per cent. Ten of Judd's patients had a visible palpable tumor of the neck in seven of these the tumor was on the left side and in three on the right side. The weight loss is greater in case the sac is large or so shaped as to close the lumen of the oesophagus. In some of his cases the obstruction was almost complete. In some of the extremely emaciated patients it seemed best to perform a gastrostomy before attempting any treatment of the diverticulum. A preliminary gastrostomy Judd believes is seldom if ever necessary.

The size of the sac of the diverticulum varies greatly. The opening into the oesophagus may be small or as large as the lumen of the oesophagus. A diagnosis can practically always be made by means of the X-ray taken after swallowing a bismuth mixture.

The method of treatment is surgical and should be made as conservative as possible. It consists of either obliteration or removal of the sac. In extreme cases it is always necessary to put the patient in as good a general condition as possible before attempting any treatment for the diverticula. When the diverticulum is small and has a large opening communicating with the oesophagus dilatation with large sounds will in some instances relieve all symptoms while in others this method of treatment may be preferable to the more radical excision especially if there is any contra indication to the open operation.

The author believes when the infolig operation described by Bevan can be performed at the primary of choice but where the dextriculus very large and he down into the thorax to old em preferable to use the otago operation as described by C. H. Mayo. These operations can be performed thoracically in most cases.

The article gives complete table of the different kinds of hernia and symptoms and types of operations in the author's series. E. C. POITSE

**S. n. r. L. T. ment of S. e. C. cicatricial**  
 St. n. e. f. th. e. O. plagus (T. m. t. d.)  
 J. d. l. P. o. 8. 553

The author says that in strictures of the esophagus frequently happen that esophagus pervious to the upper orifice of the stricture to be followed by this orifice and the undistended stricture at the orifice of the stricture is effected simply by dilating it. In such cases the stricture may be made easier and the indications for the operation are attempts to treat the stricture from above and to discontinue repeated dilatation from below upward after a gastrotomy and a thoracoscopic examination recommended by the author as the method of choice.

Contrast my according to Sencert is a simple procedure in the throat of a patient in a non-conscious patient under chloroanesthesia and when the gastrotomy is placed in the fundus of the stomach in the malnutrition and as close to the arilapable Such fistula will be generally patent.

In the stomach my the first stage of the author's technique. It proposes the treatment of the patient by the outside of the chest.

lower orifice of the esophageal stricture. Even if the esophageal stricture is temporary, the consequence of secondary impaction. The important point is that the orifice should be large enough to give ample approach. It is effected by a vertical incision along the external edge of the rectus and encroachment on the costal border or by an oblique incision parallel to the costal border opening the peritoneum and locating the stomach. The stomach is drawn into the wound and fixed to the upper angle of the abdominal incision. An incision of one to one and a half centimeters is then made in the stomach and the mucosa fixed to the skin without trying to make an incisional trajectory or valvular mucosal orifice. This operation can be done in a few minutes.

In the second stage of the operation a bougie is passed by the mouth maneuvered through the stricture and pushed to the stomach. At its buccal extremity a No. 3 or No. 4 silk thread is fixed. The finger is introduced into the gastrotomy orifice and the end of the bougie found; it is pulled through followed by the thread which acts as a guide for the subsequent upward dilatation of the stricture. This latter is accomplished by means of an attached rubber tube to the gastrotomy end of the silk thread a further thread being attached to the end of the tube; the tube is then drawn up by traction on the buccal end of the string. Dilatation of the stricture is thus effected. The tube left in the stricture lumen for varying interval and in subsequent treatments the size of the tube is successively increased until the normal size of the stricture lumen is attained.

Previously to the author had treated 18 patients with esophageal strictures in this way with entire satisfaction. He has recently treated 2 more and the full details of these cases are given with particulars of the technique. W. A. BRANNAN

## SURGERY OF THE ABDOMEN

### ABDOMINAL WALL AND PERITONEUM

**B. noni. F. G. nshot. W. und. of. cl. Abdomen**  
 (F. i. d. m. d. f. d. l. d. m. G. d. p.)  
 d. l. M. l. 9. 8. 4. 3.

The clinical data of greatest importance in the regard to peritonitis are of abdominal sounds according to Boni. The pulse at the abdominal character of abdominal rigidity. As a general rule if the pulse is greater than the extent of the abdomen is a patient with peritonitis. The pulse is usually accelerated in the time of admission from the period of injury. The meteorism and pulsation of the abdomen give important indication.

A cord is the injury is in the clinical small intestine of stomach region the degree of the descending order of gravity. The reason for this according to the author is to be found in the blood

supply as the degree of resistance of an organ to infarction directly proportional to its blood supply.

The author does not believe that a projectile in the peritoneum in the abdomen is of particular importance. His covered patients with perforated perforated esophageal and no later disturbances.

The treatment followed is as follows: antitoxic injection, aspiration, laparotomy and treatment of the lesion. The postoperative treatment consists of ventral ice pack, hypodermic clysis, fasting, a little milk after twenty-four to thirty hours removal of the tube after the eighth day.

Of 10 cases of penetrating wounds operated upon 7 recovered and 3 died and in the result 14 unknown wounds were observed. 10 of the abdominal wounds were in both the large and small intestines, one in the large intestine, one in the small intestine, one in the cecum and one in the liver.

Facial intoxication peritonitis and shock are the usual causes of death Thoraco abdominal wounds are extremely grave

If there is any doubt about an intestinal perforation the case should be operated upon but the probability of a good result from laparotomy rapidly diminishes after six to ten hours W A BRENNAN

Quain F P and Eggers C Painful Abdominal Scars *Mil S geon* 1918 xliii 195

From observations on army cases with pain in and about an abdominal scar often deep seated or radiating to the back and pointing to pathological conditions following operation the authors concluded that the causes producing painful scars are (1) simple adhesions of the omentum or gut to the parietal peritoneum under and surrounding the scar (2) small submucous hernia of omentum through the peritoneum (3) thin stretched out scars with hernia like bulging of the abdominal wall (4) retention of the appendix with adhesions following drainage of an appendiceal abscess

A fifth cause not so clearly demonstrable in the cases under observation is the inclusion of nerve fibers in the scar Excision of the scar cures these cases Cases coming under the classifications 1 and 2 were probably due to faulty technique during the operation H H FREILICH

### GASTRO INTESTINAL TRACT

White F W Effect of Stimuli from the Lower Bowel on the Rate of Emptying the Stomach *Am J Phys* 1918 11 84

It has already been shown by Cannon and others that irritation of the colon may delay the emptying of the stomach especially when powerful stimuli occur in intestinal injury such as cutting drying or handling the bowel Here there is a definite protective mechanism holding back food until some measure of healing occurs below The results of a series of experiments enumerated here point definitely the same way In regard to frequency delay in emptying the stomach is the exception and not the rule in lesions of the lower bowel Regarding the kind of irritation a strong stimulus is needed from the lower bowel to slow the stomach

The progress of a barium meal was observed with the roentgen rays and fluorescent screen in men and in cats avoiding such factors as emotion and trauma as much as possible Irritants were injected through the rectum under the fluorescent screen

The effect of mechanical filling or distention of the colon had little or no effect upon the emptying of the stomach Food passed steadily through the pylorus while the enema was retained and the stomach was entirely empty within the normal period in each of the ten cases examined In a series of cases where there was definite or marked delay in emptying the small intestine or stasis in the ileum the stomach emptied promptly The pyloric spasm is variable and uncertain and has

little constant effect on function Smithies found persistent gastric retention in only a little over 3 per cent of pyloric spasms associated with appendicitis and cholecystitis Intermittent retention was frequent and usually disappeared after removal of the appendix or gall bladder

The effect of chemical irritation of the bowel was tested out in cats by means of turpentine oil croton oil and mustard oil being injected through a well oiled catheter According to the degree of irritation in the caecum the following results were obtained (1) Intense irritation caused prompt reverse peristalsis in the stomach with vomiting of its whole contents (2) marked irritation caused either delay in emptying the stomach up to about twice the normal time evidently due to spasm of the pylorus or hyperperistalsis and rapid emptying of the stomach and the whole digestive tract (3) moderate or slight irritation had no effect on the emptying of the stomach A perfect gradation of results was not obtained evidently because of the part played by spasm which was very variable

Data in another group of intestinal cases in which disease is present show delay in emptying the stomach after a barium meal to be the exception and not the rule In 7 cases of chronic colitis and 3 cases of tubercular ulceration of the colon there was no delay In 5 cancers of the colon there was no delay In 5 cancers of the colon causing more or less obstruction of the caecum and ascending colon of the transverse colon and one of the sigmoid there was no delay In one case of chronic intussusception of the ileum one foot above the ileocaecal valve there was no delay There was little chance to study acute appendicitis because early operation is needed

Intestinal involvement is important as is the element of pain even such a lesion as fissure of the anus if very painful may cause delay and a good sized six hour residue in the stomach

Clinical and experimental observation in lesions and irritation of the upper bowel (duodenum and jejunum) have shown that they often delay emptying of the stomach

Evidence indicates that delay in emptying the stomach is the result of impulses through the vagus causing pylorospasm not inhibition of the motor fibers of the stomach through the splanchnic nerves The delay in emptying the stomach caused by spasm of the pylorus is very variable present one day and absent the next under similar conditions In general marked delay in emptying the stomach is far more often the result of actual lesions about the pylorus than of reflexes from the bowels

I W BACH

Baetjer F H and Friedenwald J Certain Clinical Aspects of Peptic Ulcer with Special Reference to Roentgen Ray Diagnosis as Observed in a Study of 743 Cases *Bull Johns Hopk* 1918 p 17

At the meeting of the Association of American Physicians in 1912 Friedenwald presented a paper



on a clinical study of 1000 cases of ulcer of the stomach and duodenum and again in 1913 he presented the value of the X-ray in the diagnosis of the affection. Since then a further series of 743 cases has been studied by the author in order to have these cases been followed clinically but a careful X-ray study has made necessary instances. The method followed is detailed in the publication in the form of a paper. The first group in the clinical study and then with any number of groups to the nature of the lesion were entered in a series of tables. The reports were then placed side by side in order to determine the clinical and X-ray diagnosis and prognosis.

The 43 cases may be divided into three groups: (1) Cases in which the diagnosis was definitely proven; (2) Cases in which the diagnosis was highly probable; (3) Cases in which the diagnosis was highly probable but not definitely proven.

Of the 43 cases, 11 were of the ulcer of the stomach, 11 of the ulcer of the duodenum, and 21 of the ulcer of the stomach and duodenum. The 11 cases of the ulcer of the stomach were divided into 6 cases of the ulcer of the stomach and 5 cases of the ulcer of the duodenum. The 11 cases of the ulcer of the duodenum were divided into 6 cases of the ulcer of the duodenum and 5 cases of the ulcer of the stomach and duodenum. The 21 cases of the ulcer of the stomach and duodenum were divided into 11 cases of the ulcer of the stomach and duodenum and 10 cases of the ulcer of the duodenum and stomach.

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According to the observations the functional signs are often as important as the presence of the filling defect in arriving at a diagnosis. In such cases as 8 per cent of the cases although there

were no defects found the functional change pointed definitely to ulcer.

4 The greatest difficulties arise in the diagnosis of complicated cases that is when adhesions are present. These frequently mask the usual findings that the first impression is to determine whether the case is really an ulcer of the stomach or a lesion of some other organ. When the ulcer is situated at or near the pylorus signs of partial obstruction frequently establish the diagnosis.

The X-ray affords an almost absolute measure of differentiating between gastric and duodenal ulcer.

6 By means of the X-ray examination the presence of full contraction is usually ruled out.

The degree of healing can be approximately determined as well as recurrence of ulcer which can not be clinically determined in any other way.

8 One can obtain sufficient evidence as to the extent and induration of the ulcer and degree of obstruction to serve as a guide for the necessity of surgical treatment. G. E. Br.

Hands S. G. Medical and Surgical Treatment of Peptic Ulcer. J. I. St. M. S. 98 87

The relative frequency of ulcer and gastric cancer of peptic ulcer cases deduced from a review of the literature and the opinions of the best clinicians the author suggests treatment for the following reasons:

1. The ulcer is dangerous between peptic ulcer and gastric cancer.

2. The ulcer is dangerous between peptic ulcer and gastric cancer.

3. The ulcer is dangerous between peptic ulcer and gastric cancer.

4. The ulcer is dangerous between peptic ulcer and gastric cancer.

5. The ulcer is dangerous between peptic ulcer and gastric cancer.

6. The ulcer is dangerous between peptic ulcer and gastric cancer.

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13. The ulcer is dangerous between peptic ulcer and gastric cancer.

14. The ulcer is dangerous between peptic ulcer and gastric cancer.

15. The ulcer is dangerous between peptic ulcer and gastric cancer.

16. The ulcer is dangerous between peptic ulcer and gastric cancer.

two days before admission had been suddenly seized with violent epigastric pain. Seven or eight hours later she commenced vomiting which continued incessantly during the night. Her bowels moved normally once before vomiting set in. The next day a doctor was called who administered an enema; this gave a good result. However she continued to suffer pain and to vomit large quantities of yellowish green fluid sour to taste with an offensive odor coming up incessantly despite the fact that no food had been taken for thirty six hours. She was then sent to the hospital.

The abdomen was enormously distended with a marked prominence below and to the left of the umbilicus. This protrusion was exquisitely tender to the touch and highly tympanitic. During the examination which lasted nearly half an hour there were three distinct crises of visible peristalsis, the waves passing from the left above downward and to the right. Succussion splashing was very marked below the umbilicus. The patient had not passed urine for twenty four hours.

The patient was placed in bed with the foot raised on a chair. She was placed prone on her face with a large pillow beneath the pelvis. Nutrient enemata with brandy were administered every three hours during the night and a subcutaneous saline was given under the breasts. By morning the stomach distention had receded and there was no pain or vomiting. She made an uneventful recovery.

These two cases led the author to look up the subject in the literature and from his studies he has made the following conclusions:

1. Acute dilatation of the stomach is a clinical entity of more frequent occurrence than the textbooks would lead one to believe. It may arise after any abdominal operation or in the course of a long illness.

Gastric retention is the primary condition in about 25 per cent of cases duodenal obstruction supervenes as a secondary phenomenon.

3. Gastric atony is necessary for its occurrence the primary distending agent is most probably gas due to air swallowing during narcosis.

4. Early recognition of the condition and prompt use of the stomach tube will suffice to prevent the secondary duodenal obstruction. Operative intervention for the relief of the fully developed condition is unnecessary and futile in the majority of cases.

5. The use of the prone position and a replacement by intravenous saline solutions of tissue fluid depleted by vomiting has saved many apparently desperate cases and should be adopted as a routine procedure.

6. The etiology of the condition is as yet obscure further study along the lines of experimental physiology is necessary.

G. W. HOCHREIN

St. George A. V. Congenital Intestinal Obstruction with Report of a Case. *Am. J. Dis. Child.* 1918 xv 354.

The author points out that although the standard works on embryology, anatomy, pathology, and

pediatrics seldom refer to the interesting condition of congenital obstruction of the small intestine isolated case reports are not infrequent.

In an extensive search of the literature the author has found a total of 143 cases of all kinds of congenital obstructions of the small intestine. He quotes Rowland who reported one case and mentioned four others which at operation showed a complete twist of the mesentery of the small intestine. Rowland says that inspissated meconium may cause complete obstruction which may be fatal or spontaneously relieved. Holt believes congenital syphilis to be an important factor.

The author reports a case of his own. He agrees with Kreuter's theory as do also Quain, Bailey, Miller, and Fossner that there is absence or imperfect development of the lumen of the intestinal canal at a certain time in the development of the embryo (thirty to sixty days) that at first the intestine is hollow but as a result of hyperplasia of the lining epithelium temporary closure results which in the normal fetus reopens. Failure to reopen gives various types of atresia or stenosis. He believes that considering the embryologic development of the intestine this process will account for a considerable number if not the majority of the cases.

He also quotes Schwalbe who noted that in high stenosis the abdomen is retracted and in low stenosis the abdomen protrudes. Also Pfundler and Schossman who mention abdominal pain, obstinate constipation, deficient flatus, uncontrollable vomiting (at first food and later mucus, bile and blood), meteorism, purpura, visible peristalsis, intestinal spasticity, tumor (Nathagel's phenomenon) and finally collapse.

H. J. VAN DEN BERG

Morison R. A Case of Intestinal Obstruction with Comments on Bursts of the Intestine. *Brit. J. Surg.* 1918 vi 135.

The author cites a case of intestinal obstruction and in connection discusses the etiology of bursts of the intestine.

The patient, a man of sixty six years, was admitted to the hospital February 21, 1918. Since the age of twenty he had had stomach trouble at frequent intervals. During the attacks he vomited and had some epigastric pain but never vomited or passed blood. The attacks were always cured by rest and freedom from worry. For thirteen years previous to the present illness he had been more than usually well.

The present trouble began in the early months of 1911 and seemed to be of the same nature as the previous attacks. Digestion gradually became worse and about six weeks before admission additional pain augmented the digestive disturbance. On five occasions after dinner at night he had been attacked by paroxysmal pain. After going to bed a feeling of distention followed by a violent pain developed. The pain always began at the umbilicus and sometimes spread to the right side but never reached as high as the costal margin. It was accompanied by loud rumblings of wind and inability to pass flatus.



associated with some form of inflammation and occurs in two main histological varieties a form with small cells and usually much fibrosis and secondly a cylindrical cell type resembling carcinomata of other parts of the intestinal tract

Sixteen cases of primary carcinoma of the appendix are analyzed in this paper and each case may be seen to fall into one of the two classifications viz the small cell type and the columnar cell type. All of these cases present a rather composite picture bringing forth the following findings

In practically every case there was an ulcerative process bringing the case to operation. Generally the small cell type showed fibrosis with nests of epithelial cells in a connective tissue framework. Occasionally a small tumor mass was found and was liable to show in any part of the appendix. The mass might be found also in any one of the layers of the appendix infiltrating to any of the other layers. The nests were made up either of more or less degenerated cells staining poorly in cytoplasm and nuclei or well staining cells with dense nuclei. In a number of cases there was lymphatic infiltration and some hyalinization. The main difference noted in the two types was in the histological form.

A summary brings out the following facts

1 Sixty five to seventy five per cent occur in females

2 The age is usually in the second and third decades with the extremes at five years and eighty one years respectively

3 The great majority of cases show the condition is essentially benign although metastases and extension have been reported. The columnar cell type seems to be the more malignant though data are in conclusive

4 In no case was the diagnosis made clinically. In four cases the tumor was diagnosed grossly and in four cases it could not be recognized grossly even when the histology was at hand

5 Practically all the tumors were situated at the tip or in the distal third. A bulbous tip was exhibited by four I W BACH

Cotte G Appendicostomy in the Treatment of Severe Acute Dysentery (De l'appendicostomie dans le traitement des dysenteries aiguës graves) *J de chir* Par 1918 xiv 463

Cotte does not know whether others have tried surgery in the acute forms of dysentery. Having watched the evolution of a number of severe cases it seemed to him that this essentially intestinal disease localized to the large intestine would benefit from an operative intervention which would give rest and lavage to the tract.

Up to the time of report he performed appendicostomy in 5 severe acute cases which medical treatment failed to relieve and with very advantageous results. The cases were operated upon from the fifteenth to the twentieth day after onset. Four of these cases recovered. The fifth case an ulcerated gangrenous dysentery had a fatal termination.

Incision is made over McBurney's point. The appendix is resected keeping a short stump to pass a suture. The cecum is fixed to the parietal peritoneum by silk sutures. The wall is then closed with the exception of a passage for the sound. A general anesthetic is used. For the lavage nitrate of silver solutions 1:1000 every one or two days while loose stools continue have been well tolerated. The cases in which appendicostomy was tried were not selected but all were cases in which other therapeutic measures had been tried in vain. W A BRENNAN

Rojas D A Rupture of the Colon by Abdominal Contusion (Rupture del colon por contusión de abdomen) *Semana med* Buenos Aires 1918 xiv 724

The patient was struck in the abdomen by the pole of a cart. He walked to the hospital supporting the abdomen with his hands. On examination he showed extreme pallor, an expression of intense pain, hypotensive pulse, dyspnea. The right hypochondrium showed that the musculo-aponeurotic plane was ruptured but the skin was intact although ecchymotic. There was intense pain on palpation in the region. The patient was evidently shocked. Injection etc failed to give relief and five hours after entrance a laparotomy was done after a diagnosis of probable rupture of the colon with internal hemorrhage.

All the tissues of the abdominal wall were found ruptured except the skin. Blood welled up abundantly through the incision. In the transverse colon a few centimeters from its origin and on its anterior face there was a contused area somewhat oval in form and about 3 cm in its greatest diameter which was perpendicular to the intestinal lumen.

The colon was exteriorized from the rest of the peritoneal cavity and a small perforation was observed in the superior angle of the area. This was repaired by double invagination of the entire contused area. Further exploration of the colon showed a fissure of the serosa in the hepatic angle and a subserous hematoma which involved the anterior and external wall of the ascending colon. The fissure was sutured, the abdomen wiped out, the abdominal wall sutured and double drains placed. The drains were removed on the sixth day. The patient was up in less than a month, the wound being perfectly closed.

The author gives some bibliographical details concerning traumatic ruptures of the colon.

W A BRENNAN

Halsey F W A Study Based upon 1400 Surgical Rectal Cases *A Eig W G* 1918 lvi 393

Halsey reports a study based upon 1400 surgical rectal cases. Many of these cases were suffering from some other pathological condition in addition to the rectal one. One of the gratifying points was the low mortality. Only two deaths occurred before the patients left his hands. Many of these cases were hemorrhoids.

The author prefers excision of the clamp and cautery method in the treatment of his cases. As a general rule he waits until the patient is on the table fully dilated before deciding on the method to use.

The technique employed in the excision method is as follows: A tight No. 10 catgut suture is placed at the upper end of the hemorrhoid and tied. A double ligature is then placed through the mucous membrane of the perianal area, a ligature is placed through the skin that the hemorrhoid is to be removed. The double ligatures are then placed around the hemorrhoid. The hemorrhoid is then removed by cutting between the two ligatures. The hemorrhoid is then removed by cutting between the two ligatures.

In the author's experience, the hemorrhoid is removed by cutting between the two ligatures. The hemorrhoid is then removed by cutting between the two ligatures.

The hemorrhoid is then removed by cutting between the two ligatures. The hemorrhoid is then removed by cutting between the two ligatures.

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The hemorrhoid is then removed by cutting between the two ligatures. The hemorrhoid is then removed by cutting between the two ligatures.

**Bruce J. R. Congenital Stricture of the Anus. J. M. St. M. 1908, 9.**

Bruce reports a case of stricture of the anus. The mother delivered the child by cesarean section. The child was born with a congenital stricture of the anus. The stricture was removed by a surgical procedure.

The stricture was removed by a surgical procedure. The stricture was removed by a surgical procedure.

**Cahoon J. H. A Rational Procedure for the Excision of Hemorrhoids. W. D. T. 1908, 13.**

To prevent the cicatrix which may follow after the clamp and cautery method and the sapremia and loughing following the strangulation method, the author describes an operation which he says obviates these difficulties. This procedure involves concerns only well developed hemorrhoids with hypertrichia and a large arterial blood supply and not the small enough external tumors that can be ligated and a blood clot turned out.

Local anesthesia is used. The hemorrhoid is then removed by cutting between the two ligatures. The hemorrhoid is then removed by cutting between the two ligatures.

**Landsman A. A. The Removal of a Sigmoid Hemorrhoid by the Method of T. A. B. Met. W. D. T. 1908, 9, 8, 53.**

The author believes that the ideal operation for a sigmoid hemorrhoid is the removal of the hemorrhoid by the method of T. A. B. Met. The hemorrhoid is then removed by cutting between the two ligatures.

He believes that the patient ought to have his bowels thoroughly cleansed by the administration of a large enema the night before the operation.

He believes that all hemorrhoids should be removed by the method of T. A. B. Met. The hemorrhoid is then removed by cutting between the two ligatures.

No matter what the operation, the method must

M. A. B. KESTEN

comply with certain definite conditions such as the following (a) the operation must be safe (b) it must accomplish the purpose intended (c) it must be reasonably free from dangerous complications and from pain (d) it must do the work in the least possible time both as to enabling the patient to get up from his bed and to return to his regular duties (e) it must be free from a complicated technique

Measuring by the standards Lindsman believes that the ligature method comes nearer to complying with this formula than do either of the others. He emphasizes the fact that work about the rectum must be done with the same scrupulous cleanliness and rigid asepsis which is practiced elsewhere. The sphincter should be well dilated as a preliminary in all rectal operations. No mouth or toothed forceps or sharp pointed clamps should be used. A groove is made to hold the ligature to provide a pelicle and to get rid of redundant skin. The ligature should be of strong linen thread. The tissue above the knot should be tied taking care to leave a safe margin to prevent the ligature from slipping. A half inch strip of gauze is inserted into the canal to keep the edge of the wound apart a sterilized vaseline dressing is applied and a tight T bandage completes the operation.

In the after treatment in cases of inability to empty the bladder the usual measures are tried. Sometimes it is necessary to remove the drain in the anal canal. A hot sitz bath occasionally acts very well. The bowels are moved on the fourth day by means of a dose of castor oil. Healing of the wound is

hastened and granulations stimulated by the application once a day of 2 per cent silver nitrate 50 per cent balsam of Peru or 10 per cent ichthyol on cotton swabs. If there is any excessive narrowing of the canal prompt measures must be taken to overcome it by passing into the rectum Wales bougies of appropriate size twice a week. E. C. ROBITSEK

## LIVER PANCREAS AND SPLEEN

Helms J. S. Treatment of Tropical Abscess of the Liver. *South M J* 1918 xi 582

The author emphasizes the following points in the treatment of tropical abscess of the liver:

- 1 It is unnecessary and a bad practice to make exploratory punctures for diagnostic purposes on account of the fact that the exploring needle will nearly always have to be passed through a part of the pleural cavity or through the peritoneum and in this way these cavities are liable to be contaminated with infectious bacteria.

- 2 These abscesses should always be treated by the open method unless there is some contra indication to operation.

- 3 The peritoneal or abdominal route is the safest and best avenue of approach and gives good opportunity for reaching and draining the abscess without danger of infecting the pleural cavity or the lung.

- 4 Local application of amebicidal remedies through the operative wound is an important part of the treatment. F. B. FREILICH

## SURGERY OF THE EXTREMITIES

### DISEASES OF THE BONES JOINTS MUSCLES TENDONS CONDITIONS COMMONLY FOUND IN THE EXTREMITIES

Adair F. L. The Ossification Centers of the Fœtal Pelvis. *1m J Obst N Y* 1918 lxxviii 175

Adair's elaborate and detailed paper is a report of work performed in the laboratory of the Department of Obstetrics and Gynecology of the Institute of Anatomy of the University of Minnesota. This report is accompanied by numerous skiagraphic reproductions and by extensive tables giving in detail the centers of ossification as shown by transparent specimen by X-ray and by serial section. As a result the paper does not lend itself readily to an abstract. The author's own summary is given:

- 1 The first ossification center of the pelvis to appear is in the ilium about the 60th to the 65th day of foetal life in embryos with a c r length of from 30 to 35 mm. There are no separate secondary center.

- 2 The median center of the first sacral vertebra is the next to appear about the 44th to 66th day in embryos having a c r length of 51 to 52 mm.

- 3 The lateral sacral centers first appear when two or three median centers are present in embryos 80 to 82 days old having a c r length of 65 mm

- 4 The ischial center appears about the 94th to 98th day in embryos whose c r measurement is from 88 to 100 mm.

- 5 The pubic center is present on the 129th day in an embryo with a c r length of 150 mm. At this time all other centers which appear until just prior or subsequent to birth are usually apparent.

- 6 Practically all antenatal pelvic ossification centers are evident by the end of the 10th week of foetal life. CAREY CULBERTSON

Guarini C. Osteoporosis in War Injuries and in Some Chronic Inflammations (L'osteoporosis nei traumatismi di guerra ed in alcuni processi infiammatori cronici). *Polichini* Roma 1918 lxxv s 2 med 2

Guarini says that the wide use of radiology is causing a renewal of interest in osteoporosis which is frequently observed by this means.

In war and other injuries osteoporosis is frequently found in the articulation immediately distal to the injury for instance in the bones of the hand with a forearm wound. But osteoporosis may occur with slight injuries such as dislocations, small subperiosteal fractures, etc. Delorme in 1350 radio-graphs of bones found osteoporosis (1) in half of the

a s f m t r p a l i n ) e ( ) i n o n e f u r t h o f t h e  
f l n a n j u e s ( 3 ) n h l f t h e c a s e s f r a d i a l  
i n j u ( 4 ) i n l a l f t h e c a s e s o f h u m e r u n j u r e  
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G u r i n l a m a l e a b o u t 3 5 0 r a d i o l o g i c e x a m i  
n a t f b n e l n a n l h a f s e a b o u t t h e  
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t h l i m m b l t i n t o h c h t h e p r t s u b y c t  
l T h e l e t u t f t h e e p h y e l c r t i l a g e  
i n t l t h t h e n o m l p r c e s e o f n u t r i t  
i m m l l t f a c t r n g t t h e c o m p s n  
f p i t u o n t h e f t p a t s h c h i t e f e s  
t h t h u l t

T h l r m l e o f t r u m a t s m h c h i n  
d t g e t i c c a e t p r i c a l l f m r e  
t h u l k l e l g e a n d u d y f t h e c a l i t o n t h n  
t h y t l l t p r e s e n t i t t k n a w t h  
t t y h n t l p c e c o m m e n l f  
t i l n e a l e

T l t h r e c n n l n e p e m e n t l a n  
c t g t f t h e h l c e i f r a t e u d  
t h e c n d t f i e e l r e p i r a t y n d  
g t r n t e t l c h n e c h n t h l a n d f  
i n t e r l a c t e t c H e p l a n t k p u c h a  
t l y l t e W A B

H n d n M S L o o B d n t h E l b w  
J o i n t J l M f q b l 7

The author believes that the general lack of  
knowledge concerning the prevalence of loose bodies  
in the elbow joint has been accounted for by the fact  
that looking through the joint in the elbow  
does not cause the meniscus to move out of place  
and after getting a look at it one would cause the  
thickened meniscus to move out of place  
thickened meniscus to move out of place

H l d i d e t h e m t t g p t t h e  
l e t l y l e t o t u m a f r c t r e n d ( )  
t h t d e t i n c t l y d u t t u n t h e l o e b d e  
u g n n u m b e r y n g f r m n e t t e t y  
o m r H e f e l l y t h e l a t t e r c n d i t n  
t h t l e

H l e s a b f u m f t h e l i t e a t u d e l g  
t h t h c o n l t d a f t e r a c a f u l t u d y o f t h e  
u b j e t t a d t t h e f o l l o g l u o n  
l o e b d t h e e l h o j t h e n t b n  
o f r e c c u e

The T l o y d u b t f u l T r u m a i s a f a c t o r  
b u t n o t t h l e f a c t o r T h e y n v i a m a y b e s o l e l y  
e p o n b l c h c n l i t o b e i n g c a l l e d t  
h n d m t

3 I f l f t n t h e j o i n t t h e t e n d e n c y f r t h e  
b o d i e s t o e e i n n u m b e r t h e f o e t h e i r e  
m o v a l l e d t e d p r o d e d t h e p a t n t s g e n e l  
c n d i t n s t i f a c t o r y H J V n d n B e

M y r d n g H W D i g n o s s a n d T e r m i n t o f  
T u b e r c u l o u s A t l t i f t h H p J n t M  
t M d q s o

Meye d n g n h s w o r k i n t h e M a y C l i n i c h a s  
f o u d t h a t i n o c n e c u t i v e c a s e s f t u b e r c u l o u s  
a t h r t s f t h e h i p j o i n t t h e e v e r s p a t i n t h e  
f i r s t d a i l e f i l e 2 3 i n t h e s e c o n d 4 i n t h e t h i r d  
n t l e f o u t h 4 n t h e f i f t h a n d 4 i n t h e s i x t h  
T h a v e r g e d u r a t i o n o f t h e d e a s e b e f o r e e x a m i  
n a t i o n a t t h e C l i n i c w a s o m o n t h t h o r t e r w e e k s  
a n d t h e n s t p r l o g e d 4 6 3 c a s e s H e h a s t h e f o r e  
c n c l d e d t h a t t h e p r a c t i c e c o n s i s t s p r i n c i p a l l y o f  
l i n g t a d i n g s e v e r o n g l c t e d c a s e s T h e h i s t o r y  
i n t h e s e c a s e s c l e a r l y s h o w e d t h a t r l y d a g n o s i s  
a n d p o p e r t e a t m e n t w a s i n t i t u t e d o n l y t o b e d i  
c r e d i t t h e t e r m i n a t i o n o f a c u t e s y m p t o m s t o b e  
f i l l l b y e c u r n e t h e f r m a t i o n o f a b s c e s s  
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H l e l e e t h a t t h e d g n o s h o u l d d e p e n d a  
a c c u r a t e l y r t t h i s t y c l c a l e x a m i n a t i o n s u b  
s t a n t i a t e d b y t h e r e n t e n o g p h a n d t h e l a b o r a t o r y  
n d g s O n s h o u l d n o t d e p e n d n e t h e r t h e e n t  
g e g r a p h i c e a m n a t n o r l a b o r a t o r y f i n d i n g  
a l n H e l y s p a t i c u l r s t r e s o n t h e h i s t o r y  
b r i n g i n g o u t t h e i n s i d i o u s o n e t e x p o s u r e t o t r a u m a  
i n f e c t i o n e t c

F r t y f o u r p e r c e n t o f t h e p a t i e n t s a t t h e M a y  
C l i n i c g a v e a h i s t o r y o f t r a u m a d i r e c t l y p r e c e d i n g t h e  
p r i m a r y c o m p l i c a t i o n a n d 7 0 p e r c e n t e x p o s u r e t o  
t u b e r c u l o u s i n t h e h o m e a n d t d

A m g t h e a l s t s y m p t o m s a e m u s c l e p a i n  
l i m p i n g n a n d a t p h y t h e p a t i e n t f r e q u e n t l y  
r u n t h e e l l f o t n t l e i n f e c t i o n e p u h g  
d n a t h e f f o r t o f t c t i n n d h a t i n P a n  
s t e n e f d t o t h e j o i n t N i g h t c e s m a y o r  
y n t b e p r s e t n d e n t n t h e m e l e s d a g  
t c b u t c a t e d w i t h t h e r s y m p t o m s a d i n  
t h e c n l u s n L a t e r l e f m t y s h o t n g p c  
t l y t h i c k g n d o l d a b s c e s t r m a t i o n m y  
b m e e v i d t

R e n t e n o g p h c f n d n g s r e d e p e n d e n t o n t h e  
s t g e f t h e d s e s e v a y n g f y n t i a n d  
t h i c k e n e d d t e n d e d p u l e t a e o f a e f c  
t n n d g e n e r l h z i n s o r d e t u t o n f t h e e n t r  
j t a n d a t b l u m t h u p a d d p l a c e m e t o f  
t h e g e t e r c h n t e

H e c i l l t t e n t n t t h e v a l u e f l n P r q u e t  
t s t n c h i l d r e n u n d e r t h e e y e s o f g e I t s l d e  
a l e t h i n c n g a g e l p i a t n  
a n d g u n e p i g n o c u l a t i o n p r o v i n g t h e p r e s e n c e  
o f t u b e r c u l o u s i n a l v d e n c e T m p e a t u r e  
n g h t e s o t h e r t u b e r c u l o u s l s n e t c g i v e  
f u r t h e r e v i d e n c e f t h e d s e a s e

H e g i e a e r y g o o d t b l e o f d i f f e r e n t a l d g n o s  
r f a u m t c a t h r t s o p e r r t c u l a n j u y i  
d i f f e r e n t i a t e d b y l o c a l t e n d e r n e s s c h y m o s i t y t h e  
h t r y n d a e g a t i v e r e n t e n o g p h w h i l e i m  
p c t f r a t u s e s l a t e r c a u s i n g a l i m p a n d h t e n  
g d u e t l e n i n g u p o f t h e i m p a c t i o n g e p o s i  
t i e o n t e n o g a p h

Chronic hypertrophic arthritis appears in older persons and shows characteristic lipping arthritis without rarefaction. The limitation of motion is usually in abduction and rotation and there is little or no muscle spasm shortening etc.

3 Infectious arthritis is usually multiple acute and accompanied by high fever and leucocytosis. A search for focal infection and its removal lead to rapid recovery. Aspiration and bacteriologic examination aid in differentiation.

4 Perthes disease or epiphyseal osteitis deformans juvenilis may be differentiated by the characteristic epiphyseal changes.

5 Infantile paralysis is easily differentiated in the paralytic stage. In the acute stage there may be local pain and tenderness for a short time which soon leave a typical paralysis.

6 Arthritis of the knee allows motion of the hip without pain when the knee is held immobilized and the entire limb carefully manipulated.

7 Little's disease of the lumbar spine has as its earliest symptom muscle rigidity. Careful manipulations of the hip with roentgenographs will make clear that the hip itself is not involved.

8 Congenital dislocation lacks muscle spasm rigidity atrophy etc. and is positively diagnosed by the gait palpation and the roentgenograph.

As to treatment Meyerling believes that sunshine, fresh air and simple substantial food are the most useful general aids and preferable to dosing the patient with medicine. The local treatment is dependent on the stage of the disease and the circumstances. He prefers the Jones abduction frame which allows fixation and extension, relieve pain and spasm and at the same time corrects the deformity.

The patient should remain on the frame until all the acute symptoms have subsided, the general condition has improved, the deformity has been corrected and roentgenographic examination shows redeposition of the salts. In adults the acute stage may be treated by Buck's extension, the limb being supported by sandbags. During the subacute stage if no drainage exists a cast of the Lorenz type may be used together with crutches and the elevation of the sound limb by means of a patten. The length of time of treatment depends on the individual case.

At the time of examination in his series 90 per cent of the patients showed deformity, the flexion adduction type being practically always present. Nineteen per cent were ankylosed and the average shortening was 2 1/4 inches. The patients with deformities and those in the subacute stages were treated by brisement force with ether anesthesia and plaster casts followed by crutches. Osteotomy of Gant's type was performed in cases in which the deformity had become ankylosed. G. W. HODGKIN.

Steinhardt E. C. Infection of the Female Genital Tract Its Relation to Arthritis. *Ohio St. M. J.* 1918 xiv 468.

Two cases are presented of joint symptoms due to a primary focus in the female genital tract.

The first is a woman fifty two years of age who showed tenderness pain stiffness and slight swelling of the joints for a period of two years. Various joints were involved and the discomfort fluctuated in intensity but never entirely disappeared. Except for a proctitis which was relieved by pessary treatment two months prior to the onset of the joint disturbance the health had been good. After wearing the pessary there had been a thick yellowish vaginal discharge which gradually became very profuse. Physical examination revealed nothing except the joint and vaginal conditions. A hard rubber pessary presented just within the introitus. The tissues were atrophied around the pessary and removal was done under an anesthetic. Speculum examination revealed an erosion about the size of a five cent piece and of considerable depth in the posterior fornix. This was bathed in pus and a culture yielded a growth of pure staphylococcus. Under local treatment the discharge ceased and the erosion healed. Coincident with this the joint symptoms diminished and in a short time disappeared without any recurrence.

The second case was a patient twenty two years of age married five years. There were two children both normal births. For five months he had a profuse leucorrhoeal discharge but in all other respects was healthy. After missing two menstrual periods she aborted. Thirty six hours later she felt feverish and developed thirst. Herpes appeared and the right wrist became red tender swollen and painful. Cultures made of the uterine cavity yielded staphylococci and a small number of bacilli. Blood cultures gave staphylococcus in pure growth. Under treatment the condition cleared up and the inflammation of the wrist subsided. Other joints meanwhile became involved but in the course of time the arthritis disappeared and normal function returned. The left knee was aspirated but no growth was obtained.

Two rabbits were injected intravenously with the organism obtained from the blood culture in this last case. Both developed lameness and autopsies showed joint changes. I. W. BAKER.

Rugh J. T. Foot Prophylaxis in the Soldier. *Am. J. Orthop. St. S.* 1918 x 1 330.

The author describes the foot conditions that are found among soldiers and the methods of treatment that are available in an army camp. He states that military and psychological problems often stand in the way of success of the work and that the results are secured with difficulty. Four factors he states stand out in the solution of these problems each of them capable of thwarting the efforts of previous success.

1 Feet. All types and all conditions are presented. The number of deformities he believes are about the same as those found among the allies.

2 Shoes. He believes that the Hun on shoe can be fitted to 98 per cent of men and a great number of foot conditions can be prevented or cured by



the shoe. Suggestions are given as to the care of the heels and the socks as well.

3 Officer. He states that they are responsible for the accident in the shoe. The officer should be trusted in the care of feet shoe fitting all the attention and general hygiene.

4 Sillie. They should be properly fitting shoe and get proper care of the shoes. Trouble with the feet may be explained when some talk becomes common. Unpleasant in the case of the disability. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

5 F. M. L. Thompson. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

6 T. L. J. Thompson. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

7 H. L. J. Thompson. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

8 K. L. J. Thompson. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

## FRACTURES AND DISLOCATIONS

9 Motion C. A. Thompson. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

10 The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

11 If the metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

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abducted. The splint cannot be used for fractures higher than one inch below the surgical neck of the humerus. If a fracture is at this high level, one must be content to fix the arm in an anteoposterior splint with forearm projection fixed by plaster against the chest wall.

The splint is best applied with the patient standing on sitting on a stool with body erect and shoulder level. The splint is well padded and the forearm placed in pronation and left uncovered for massage and electrical treatment in the muscles of the forearm. The arm is attached to the chest wall by plate of plaster and the arm may be passed over the opposite shoulder if needed easily.

V. C. H. W.

13 G. L. H. W. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

14 G. L. H. W. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

15 The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

16 The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

17 The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot. The metatarsal phalanx of the foot is the draft of the metatarsal phalanx in all cases of the foot.

W. A. B. A.

**Turner P** Gunshot Fractures of the Femur  
Some Methods of Reducing Serious Displacements  
*Lancet* Lond 1918 cxcv 74

Treatment of compound fractures of the femur on the Thomas splint has been so generally adopted and has so many advantages both as regards comfort of patients and easy performance of dressing with the least amount of pain and disturbance of fragments that the following remarks apply only to patients treated in this way.

Serious displacements will come under one of the following heads

1 Shortening. This is often due to obliquity of fracture or to overlapping of main fragments which can be overcome by efficient extension. The author has used steel spring to obtain extension the springs of ordinary spring mittre seem answering very well. They are easily attached and have distinct advantages over other methods of extension.

Rotation. With a Thomas splint rotation may occur. This can be prevented by the use of lateral supports with tape to be attached to the bars of the splint.

3 Sagging can usually be prevented by proper adjustment of the supports of the splint.

4 Displacement of comparatively small fragments at the ends of the bone to which powerful muscles are attached may be difficult to rectify. The wire suspension and traction method is often effective. A loop of silver wire is manipulated over the free end of the displaced fragments and pulled into position where it is maintained by attaching the wire to a rigid arch passing over the limb between the two bars of the splint. It may at times in order to attach the wire to the fragment be necessary to enlarge the wound or make a fresh incision. The presence of the wire causes no irritation or increase of sepsis and there is no pain if the wire does not press against nerve trunks.

The shortest time the wire has been left in place is two weeks. It is better to leave it three or four weeks. Though in some cases wire suspension can be carried out with advantage as soon as the patients are admitted as a rule it should be left until the acute infection has been overcome and the swelling has subsided. The chief advantage of the method is its simplicity. V. C. HUNT

**Turner P** Method of Reducing Dislocations of the Shoulder Joint  
*Practitioner* Lond 9 8  
ci 75

Recent dislocations of the shoulder joint can as a rule be reduced by the Kocher method or by direct traction. In the presence of considerable muscular spasm or pain general anaesthesia may be necessary. Occasionally in certain unusual cases these methods fail.

In twelve such cases among which were several of long duration the following method was successfully used by the author. A towel is looped round the inner side of the arm just below the axillary folds so that the free ends pass out at right angles

to the long axis of the body. The patient is anaesthetized an assistant grasps the forearm on the injured side and applies extension strongly parallel to the long axis of the patient's body. Simultaneously the anaesthetist makes counter extension with his fingers in the axilla while the surgeon pulls the free end of the loop outwardly. There were no complications in any of these cases.

H. H. FREILICH

**Mayer L** Congenital Anterior Subluxation of the Tibia  
*1m J Orthop Surg* 1918 xvi 521

The author ably describes this deformity its pathology and suggests a measure of treatment. The article is profusely illustrated with drawings, photographs and X-ray pictures. He does not call this condition genu recurvatum nor is it a true luxation in all cases. Investigation proves that it is only a partial dislocation or subluxation of the tibia on the femur as study reveals that the extensors of the knee and the anterior portion of the capsule are shortened. The flexors may be dislocated forward so as to be converted into extensors. The patella is usually displaced forward and the anterior portion of the femoral condyles is usually flattened.

The treatment in some cases is simple and in other cases it is difficult. Many cases cannot be reduced without an open operation. The operations are discussed especially the lengthening of the patellar tendon. A case report is given.

C. C. CHATTERTON

**Teece L G** Some Points on the Treatment of Bone and Joint Wounds  
*Med J Austral* a  
1918 ii 91

In treating fractures of the femur the Thomas splint is utilized except when the fracture is in the upper third of the thigh in which event the Jones abduction frame is best. The saddle of this frame must be made of basil leather and stuffed with lambs wool to obviate the formation of bedsores which assuredly will form if American cloth or dinary leather or other stuffing be employed.

In the application of Thomas bed knee splint some of the important features are indicated.

1 The ring should fit accurately so that the counterpressure is obtained against the tuber ischi.

2 The posterior displacement of the lower fragment of the femur is the deformity most difficult to overcome and one which is present in almost every case. To correct this the posterior gutter splint should not be used but rather strips of flannel bandage 10 cm wide placed close to one another around the inner bar doubled under the limb and brought back and fastened firmly to the outer bar by paper clips or safety pins.

3 The glue advocated by Sinclair is the best method of applying extension.

4 If the fracture is at or below the lower third the Thomas splint should be bent so that the knee is flexed to 35° thus relaxing the pull of the gastrocnemius.



results as it is easily understood that the lesions are not limited to the articulation but that the infection spreads to the synovial sheaths tendons etc. In 4 such cases in the authors series amputation of the forearm was necessary in one case and will probably be necessary in another. The other two cases have a very poor functional result. W. A. BRENNAN

Le Fort R. and Colloffian P. Pseudarthroses and Loss of Substance of the Ulnar Diaphysis (Les pseudarthroses et perte de substance de la diaphyse du cubitus) *Re d'orthop* Par 1918 111.

The authors detail 15 cases or war lesions of the ulna with extensive loss of substance. Such injuries are frequent in war surgery especially after mechanical clearance operations (esquillettements). It is only exceptionally that they cause a deviation of the hand even when the lower ulnar epiphysis is drawn upward.

Losses of substance of the middle and especially of the inferior extremity of the ulnar diaphysis are not very damaging of themselves and do not call for direct surgical treatment. Disturbances of movement when existing, are due rather to concomitant lesions of the ulnar nerve muscles tendons etc. An active physiotherapy massage mechanical therapy etc. is useful to obtain restoration of function and in certain cases can be supplemented by nerve suture liberation etc.

Simple pseudarthroses of the ulna are usually more injurious than large losses of substance. They may call for osteosynthesis especially if a concomitant fistula requires operation and in case of failure a resection of the fragments may be necessary.

An ulnar radial implantation for extensive losses of substance of the superior part of the ulnar diaphysis not only restores the integrity of the forearm but it does not contrary to belief obviate movements of pronation and supination.

In case of synostosis of the lower radio ulnar articulation the resection of a segment of the ulna with its periosteum above the zone of osseous fusion allows the return of movements of pronation and supination.

Losses of substance in the lower half of the radius can be treated advantageously by graft of a fragment of the neighboring ulna. The length of the removed fragment should correspond to half of that of the loss of substance. The inverse operation an ulnar graft of a radial fragment is contra indicated. W. A. BRENNAN

Leriche R. The Importance of Regeneration of the Neck of the Femur After Extensive Hip Resections: an Operative Method of Obtaining It Primarily (De l'importance de la régénération du col fémoral après les résections étendues de la hanche et sur un procédé opératoire permettant de l'obtenir à la période primitive) *Bull et mém Soc de chir de Par* 1918 xlv 916.

When the results of hip resections involving the neck of femur are examined after some length of

time it is observed that the neck and head never regenerate. The fact is not new and was observed by Olier in animal experiments as well as clinically. This absence of regeneration in the neck is undoubtedly the real cause of the mediocre functional results obtained in extensive hip resection. No real progress has been made in this line of work and one justly is advised to attempt an ankylosis rather than a mobile joint.

In the customary methods of resection it appears to be the chief aim to open the capsule as early as possible, disinsert the muscle and expose the diaphysis to the saw.

The periosteotome works from inside outward. When the capsule is open the joint cavity is gaping and only the insertions external to the capsule are preserved. Leriche however instead of opening the capsule at once removes the neck from without commencing with its retrochanteric insertions and working as far as possible all around. The periosteotome being applied on the bone the capsule is pushed back against the cotyloid cavity as if one wished to enucleate the cotyloid head without opening the capsule. The change in technique therefore in a word is separating the structures from the bone from outside inward rather than the older method of from within outward.

Leriche insists that what he does is nothing more than the strict execution of Olier's technique of resection viz. of leaving some bone tissue to protect the frail osteogenetic layer.

By this method Leriche obtained a remarkable regeneration of all the upper extremity of the femur in a soldier whose injuries called for an extensive subtrochanteric resection. A radiograph 182 days after operation showed the neck implanted almost at right angles on the diaphysis. It gave the impression of ossification along the capsule and guided by it. Functionally the result was quite as good six months after injury the man walks three miles daily with the use of a cane. The hip is solidly in place active movements of flexion of about 30° are effected in the joint and passively some rotation is possible.

Leriche thinks this case shows

1. The possibility of bone regeneration in the primary period.

The superiority of primary resection over late resection which Leriche has endeavored for the past three years to demonstrate.

3. The modification of technique which permits in the case of hip resections what is obtained in other articular resections namely reconstitution of the joint so as to permit functioning.

Leriche thinks that it is very easy to obtain a satisfactory regeneration of the neck in the most extensive resections and even in the primary period in which it is held that periosteal osteogenesis is sufficient for the task. For this only a slight modification of the classical resection is necessary.

In the discussion by Tuffier Quénu Maclaure and others Tuffier insisted on the Olier technique

be g con ide ed an int ro ous rathe than a  
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iliac bone. It was hard, smooth and without adhesions. In view of the certain fatal issue if the tumor were left unchecked, the author decided to operate despite the gravity of operation and the poor chances of recovery.

An interilio-abdominal disarticulation was done. Antero-external and posterosuperior strips were cut following the technique of Girard of Berne; the muscles dissected; the external iliac vein and artery ligated, respecting the primary iliac and internal iliac; the tumor was isolated; the right lower limb being put in forced abduction in order to reach its internal part. The posterior sacro-iliac ligament ruptured while the disarticulation was proceeding.

Hæmorrhage was extremely slight. Anæsthesia ceased before the operation was complete. Half an hour later the patient died of syncope. Microscopic examination showed that the tumor was a fibro-sarcoma. There was no evidence of metastasis.

The author cites 16 disarticulations of this type from the literature. In 10 cases death was immediate or rapid; in 2 there was temporary survival with recurrence in a few months; in 4 a recovery considered definite. The statistics showed that 3 out of 4 patients die.

The small hæmorrhage in the author's case was due to the fact that the Mombourg method of hæmorrhisi was employed.

Discussion of the paper in addition to verifying the formidable and almost constantly fatal traumatism due to interilio-abdominal disarticulation brought out the facts that this operation was less grave in coeliac cases than when done for neoplasms, also that in order to obtain a better prognosis in cases calling for operation, recourse must be had either to a two-stage operation or to pelvic resections.

W. A. BRENNAN

### ORTHOPEDICS IN GENERAL

Freiberg, A. H. The Casualties of War and Industry and Their Relation to Orthopedic Surgery. *J. Am. Med. Ass.* 1918, LVII, 417.

The great service which orthopedic surgery has rendered in the world war has been realized because of the peculiar training possessed by orthopedic surgeons, which embraces not only mechanical skill and resourcefulness, but also a general mastery of the technique of operative surgery. The orthopedic surgeon of the past has developed into the orthopedic surgeon of the present because of the fact that his professional background has become steadily more scientific, his methods more direct and simple, and the principles of surgical pathology more sought after and followed than the prescribing of elaborate apparatus.

The orthopedic surgeon has demonstrated that a great percentage of wounded men can be returned to active military duty within a reasonable time who under former conditions would have been relegated to civil life not only with industrial usefulness impaired but as an actual burden upon their government.

The possibility of prevention of deformity and the preservation of function does not differ materially in war surgery except in numbers from its application in industrial surgery. Neither is the establishment of curative workshops, equipment for physical therapy in its various forms, and the skilled personnel to operate them peculiar to the need of war time. This should long ago have been instituted and operated in the interest of the industrial cripple.

R. B. COFIELD

Iovett, R. W. A System of Orthopedic Instruction. *J. Orthop. Surg.* 1918, XVI, 483.

The problem is to teach as much orthopedic surgery as possible in four six or eight weeks so that no incompetence on the part of the physician will result. As a rule most of the class knew very little orthopedic surgery and many had no clear conception of the anatomy, physiology and pathology of joints. It is the aim to give instruction in fundamental anatomy and physiology, applying this to the pathological conditions. Instruction should be as largely clinical as possible, every stage of progress being illustrated on patients. More facts are brought out by quizzing the class than by stating facts. The scheme is as follows:

1. Disease of the neuro and muscular mechanism. The passage of motor impulse from brain to muscle, minutely described, with resulting conditions from pathological disturbances at various levels of the nerve. Next the physiology of muscle is explained. With this data in hand various conditions such as anterior poliomyelitis are discussed. Cerebral lesions are exemplified by cerebral spinal paralysis with resultant effect on the affected muscles. Peripheral nerve injury is well illustrated by obstetrical palsy.

2. Static deformities such as foot strain, scoliosis, relaxed knees in children, etc.

3. Joints. Structure, anatomy, physiology and pathology, and diagnosis and treatment are considered.

4. Bones. The gross structure, repair and function of each constituent part of bone as periosteum, medulla, etc. are considered. This then makes clear the process in osteomyelitis, syphilis, rickets, etc.

5. Apparatus. The principles and application of apparatus are next taken up. Congenital deformities are spoken of together with the application of artificial limbs.

J. J. KUPLANDER

Young, J. K. Orthopedic Diagnosis. *Med. & Surg.* 1918, 5, 4.

The author believes that as it means to a more accurate diagnosis of orthopedic conditions, thorough clinical and laboratory examinations are of commanding importance. In a general way these should consist of two main parts:

1. There should be noted a careful history of the patient's antecedents, his own previous personal



Ortali O Wounds of the Vertebral Column and of the Spinal Cord (Ferite della colonna vertebrale e del midollo spinale) *Ga d osp ed citi Milano* 1918 xviii 465

The most interesting class of spinal injuries is that in which there are lesions of the cord. Such are due either to direct passage of a projectile through the canal or indirectly either to a bone particle projected by the force of the projectile into the interior of the canal or to the impact of the projectile against the canal wall without fracturing it.

The author dwells on the symptoms and their interpretation. He gives the symptoms for injuries in various sections of the cord. There is no special distinguishing symptom by which a complete section of the cord can be distinguished clinically from an incomplete section. Sometimes compression may be diagnosed especially when paralysis is of gradual onset.

As regards operation the author has seen several cases of complete section operated upon. They were all failures. He thinks that generally in such case operation is not only useless but dangerous because it aggravates the patient's condition. There are however some cases in which operation is indicated and in which abstention would be dangerous. These are (1) when a projectile is retained in the spinal cavity even when the symptomatology speaks for total section because it cannot be judged from the symptoms how much is due to the pressure of the projectile and how much to nerve destruction (2) when there is fracture of a posterior arch of a vertebra and the fragments are embedded and may be compressing the cord (3) when there is no complete abolition of the sensory and motor functions. Such cases are probably the result of compression with a partial cord lesion.

Operation is limited to opening the canal removal of foreign bodies examining the cord and suturing the latter when sectioned. The results of operation vary according to the lesions. There is usually rapid

improvement in cases of compression. Some illustrative cases are detailed to show the good results of intervention especially in compression cases.

W A BRENNAN

Shirpe N Cord Injuries in Spinal Fractures  
*Am J Surg* 1918 xxviii 189

In every case of fracture of the spine with damage to the cord excepting only complete obliteration of the bony canal with a hopelessly crushed cord an early laminectomy is urgently indicated to relieve the cord of the damaging effects of bone pressure hemorrhage and edema and to give the nerve tissue the best possible chance for repair.

Fracture with cord injury may be divided into two classes first fractures with symptoms of partial abolition of function and second fractures with symptoms of immediate complete abolition of function. The fate of the damaged and of many of the sound fibers depends on whether the factors producing the injury are temporary or permanent. If this compression by bone blood and the certain edema which appears after every injury to the cord is quickly removed not only will the sound fibers be preserved but functional and even anatomical repair will take place in many of the damaged but not destroyed fibers. A free opening for the dura is most important and should always be done.

The operation should be performed as soon as the patient has reacted from the shock and the site of the lesion is localized. In cases with paralysis of the bladder catheterization should never be attempted. If it is done the resulting cystitis will carry off 50 per cent of the cases. Massage of the neck of the bladder or hot rectal injections will usually be found efficacious. The author believes that suture of a severed cord should be attempted and is warranted by the great improvement in the sensory and trophic disturbances.

E A PRI TY

## SURGERY OF THE NERVOUS SYSTEM

Kawamura K and Kimura T Experience with Foerster's Operation for Gastric Crises and Spastic Paralysis *S g Gynec & Obst* 1918 xxviii 129

By Foerster's operation the authors mean the intradural resection of the posterior spinal nerve roots.

A case of gastric crises in a male laborer aged thirty nine years is reported in detail. One year following the operation the patient was in good health without return of gastric pains or vomiting.

A case of Little's disease in a peasant boy aged six is also given in full detail. At the time of his discharge following his operation it was possible for him to stand erect and to take a few steps with the aid of crutches.

The authors summarize briefly the chief points in their technique and results of the operation which they think deserve special mention.

E C ROBITSHEK

Noon C Observations on 250 Cases of Gunshot Wounds of the Peripheral Nerves *J Roy Army Med Corps* 1918 xxvi 3)

Tables have been drawn up showing the number of cases operated upon. The various nerve lesions have been classified in a tabular form and an attempt made to show the results obtained up to the present time. From a study of 30 cases the following are the conclusions arrived at.

1 The diagnosis of an injury to a peripheral nerve ought to be made at the earliest possible time.





way out of the nerve bulb and through the meshes of the tissue of the internal scar. Normally more or less of this takes place but in war cases regeneration begins very early after nerve injury and its processes proceed rapidly, this perhaps being due to the increased vascularity brought about by the inflammation and the irritation of the sepsis. Thus the nerve fibers begin to regenerate in a few days according to Italian authorities, and they branch and branch again, one original fiber becoming represented by many fibers, each of which is a potential source of trouble, it may encounter an inflammatory nodule or become compressed. Thus possibilities of future trouble are manifold. The early regeneration enables the young fibers to become long enough to be strangulated before the scar tissue has ceased to contract, and the greater number of branches of new fibers make the occurrence of trouble still more probable.

Clinically there may be distinguished at least five types of pain in amputation stumps, the first of which is universal and the last uncommon.

1. Early pain coming on immediately after the amputation dependent on an endoneuritis set up by the injuries inflicted on the nerves at that operation. When alone present this occurrence of pain dies away in a few days or weeks.

2. Compression pain coming on about two months after the interval and sometimes steadily increasing. When bearable this pain may pass off as the nerve fiber dies or the scar tissue ceases to contract.

3. Inflammatory pain. The early pain never passes off or it may become paroxysmal and severe.

Clinically these cases may be grouped in a series, pain immediately after the operation is due to the trauma of that operation and the inflammation of the reparative tissue. A little later, after from two to ten months, the pain is due to the compression of the nerve fibers by the contraction of scar tissue. Later still pain is due to active inflammatory changes in the nerve ends.

These three clinical types are distinctive both clinically and pathologically. This is not so in the fourth type, nerve regeneration gives rise to no special clinical symptom, and consequently the fourth type has no peculiar features.

The fourth clinical type is produced by the regeneration of nerve fiber. It is characterized clinically by more continuous pain and illusions as to the presence of the missing part, for instance the amputated foot. The pain is acute and first appears within a few days of the amputation. At first it is not great but increases in severity. At the beginning the new axon cylinder has no myelin sheath to protect it, and it is easily rendered painful. As the inflammation in the wound subsides the pain becomes less until the fibrous tissue of the internal scar begins to contract and to squeeze the new nerve fibers. Now the pain may be very severe and may last some months. The pain is eased considerably by heat, and in some cases by

X rays. The fourth type has clinical features of both the second and the third type.

The fifth type is only recognized clinically by the process of elimination, nerve trunk after nerve trunk is removed by operation and their consideration eliminated by trustworthy surgery. Still the pain and tenderness persist and are not of neurotic origin. The skiagram may show that it is due to disease in the bone, terminal rarefaction of the bone is due to the injuries of operation and the healing of the wound but when the bony changes are further studied they are partly due to nervous irritation, dystrophy. Such cases exhibit the usual signs of bone pain, night pain and pain in wet weather and are very persistent.

It would appear that there are many causes for non-nerve trunk pain in amputation stumps and these may be classified according to their source of origin: bone, muscle, joint, pains, etc.

Neglect to identify and cut the internal saphenous nerve may often be the cause of a painful stump.

One of the most successful amputations of the whole war is a supramalleolar amputation of the foot, a Syme's amputation. With it the patient can walk as well as he ever did and follow his ordinary avocation. Unfortunately the Syme's stumps are sometimes tender. The explanation of the painful stump is almost always the same, the posterior tibial nerve is strangulated by the large internal scar. The anterior tibial nerve has either been retracted or cut short. The posterior tibial nerve is not so easily found and is rarely cut short. Some of the posterior tibial nerve become strangulated, the majority escape.

The sciatic nerve is undoubtedly responsible for the majority of painful nerve troubles after amputation of the thigh. It very easily becomes adherent to the hamstring muscles, particularly the semi-membranosus, in consequence it is subjected to pull with each movement of the stump. It forms a well-developed bulb which is easily felt and demonstrated. A skiagram should always be taken and if it reveals the presence of any bony growths from the posterior and inner side of the femur Hunter's canal should be explored.

A very large percentage of patients, a far larger proportion than in any other type of amputation, arm or leg, who have undergone an amputation of the arm suffer from painful and easily palpable nerve bulbs on the inner side of the arm. It is not very apparent why this should be so. The nerves affected are principally three, the median crossing the artery, the ulnar between the artery and the basilic vein, and the internal cutaneous internal to the vein. These with the musculocutaneous and the lesser internal cutaneous may be caught with the vessels in the clutches of one single big scar stretching from the end of the amputation stump. The musculospiral nerve is so far away that it usually escapes being so caught. Consequently for their removal the nerve must be sought for, identified and removed.

Bony formations here are unusual while they are a plentiful and a distinctive feature on the posterior and inner part of the thigh. Forearm stump bearing very little pressure are very usually painful. In the neighborhood of the wrist the median and ulnar nerves could seem to be sed dom nipped, inflamed but they regenerate into ineffective fibrous tissue and into adherent tendons the regeneration here as elsewhere being a new formation and invading structures like malignant disease. The pull of the tendons or the inflammation and cicatrization of the scar tissue sometime makes the recision necessary.

With regard to treatment

Tenotomies of the bulb should be used together with a ligature of the nerve so as to get about any peripheral ending neuritis the case.

The benedict method of removing a nerve is by means of the epineurial sleeve advocated by Chappell and described in the *Pittsburgh Medical Journal*. August 9, page 242. A circular incision is made about the nerve where the nerve is to be put in a cuff of epineurial tissue, turned back, and an figure 8 (double some peripheral nerves are placed in the cuff) the nerve trunk is closed to the cuff which then draws it inward and its end is ligated with catgut. Regeneration is not prevented but the nerve appears later as a pencil not as a bulb. The difference in shape is due to less formation of scar tissue and the advantage is that there is less chance of nerve strangulation by the scar tissue.

3 Drainage should always be employed. A good sized tube is used. Its non use leads to hemorrhage.

4 All ligatures and buried sutures should be of absorbable material to minimize sources of irritation.

The recommendations that the author makes to those surgeons doing amputations are the following.

Let the technique be as surgically clean as possible. Much harm results from lighting a fire in a wound.

Use only absorbable sutures.

3 Cut all nerves as short as possible using the swan door method to close the mouth.

4 Cut all vessels right as they form the greatest channel to the spread of infection. By cutting them short the door is closed.

5 Drain temporarily all amputation wound using a large tube.

6 Start the Carrel Dakin treatment at the time of operation in dirty cases.

7 In clean cases close the deep wound with a few catgut stitches.

What are the results of attempts to make poorer stumps good. The results are not good. They must be improved other use reamputation give small hope of improvement.

Time must be allowed to elapse for stumps to heal and become painful. The stump meanwhile must be used and made into muscle made into useful structures by blood and lymphatic circulation stimulated by heat massage and movements and improved by means of electricity and by the early use of a cheap form of artificial leg.

D. N. C. RATH

## MISCELLANEOUS

### CLINICAL ENTITIES—TUMORS ULCERS ABSCESSSES ETC

Sitting, M. J. Fu, the Study on the Immunity of the Lymphocyte in Cancer. *Immunology* 1938, 465.

In a previous communication were reported experiments which failed to induce immunity in rats inoculated with Flexner-Jobling rat carcinoma when artificial hyperlymphocytosis was produced on the one hand or to alter their resistance to it by depletion of the lymphocyte cell circulation by bleed on the other hand. For the experiments to be successful in one set of white rats a high lymphocyte count in the blood as induced by repeated injection of pineal gland of the mouse, 1% of the mouse lymphocyte from 5 and 30 per cent 55 and 60 per cent. At the period they were inoculated with Flexner-Jobling rat carcinoma and the resultant percent of fatalities the same in the control as in the experimental rats.

In the second set of experiments a leucocyte stream from rats which had previously been treated with small or stimulating doses of X-ray was injected intravenously into normal rats so that a high lymphocyte count in the general circulation resulted and when these were inoculated with the Flexner-Jobling rat carcinoma they maintained their normal susceptibility, as the percentage of susceptibility did not differ from that in the control. The artificial stimulation of the mouse monoclonal lymphocyte in both sets of experiments had no manifest effect on immunity.

In a third set of experiment a number of nuller lymphocytes were tested by serial inoculation with the Flexner-Jobling rat carcinoma. Repeatedly almost depleting them of their lymph elements by causing the lymphocyte in the blood to fall four per cent. When these were subsequently inoculated with the Flexner-Jobling rat carcinoma their rate of immunity was not in the least altered. In their words the susceptibility of the Flexner-Jobling rat carcinoma in the case of rats remained the same in spite of the hyperlymphocytosis induced and in the other state of resistance to it was maintained in the face of almost complete depletion of the lymphoid elements in the rat.

These results are so contrary to those reported by Murphy and Morton that further experiments are advisable in order to clear up the differences.

inasmuch as an important factor in immunity to cancer was concerned. Therefore several other experiments were conducted following closely the work of Murphy except that Flexner Jobling rat carcinoma was used in this work. In eighty nine rats inoculated the tumor was excised completely ranging at different periods from ten to twenty eight days. While the tumor was out a small or stimulating dose of X ray was administered. They were re-inoculated with their own tumor in the opposite axilla. Careful blood counts were made before and after the raying to determine the degree of lymphocytosis and in all but two the tumor grew at the site of the second inoculation. In none was there a recurrence at the original site of the tumor.

These results seemed to conclude that the degree of lymphocytosis had very little to do with immunity to Flexner Jobling rat carcinoma and to test it further it seemed advisable to repeat Murphy's experiment in mice. The results obtained in mice were quite similar to those reported by Murphy and Morton excepting perhaps that the tumor recurred at the usual periods and the latency of four or five weeks after the raying could not be confirmed. Careful blood counts were made in the mice before and after raying the increase of the small mononuclear lymphocyte ranged in average from 30 to nearly 60 and 55 per cent in a total of 14,000 to 18,000 whites. The red blood cells were quite high ranging from 5,000,000 to 7,000,000. This high lymphoid generally reached its optimum in from forty eight to seventy two hours and continued for about five to six days. The tumor generally was of moderate size on the tenth to twelfth day.

Out of 93 mice treated with a small dose of X ray while the tumor was out of the body and then re-inoculated with their own tumor 54 tumors recurred 18 died during the experiment and the other 21 remained free.

GEORGE C. BEILBY

Colvin A. R. Lower Back Pain. *Am J Orthop Surg* 1918, xvi 384.

The causes of lower back pain are quite numerous and a careful examination is usually necessary to determine the exciting factor or factors. The pains and aches of acute febrile disturbances especially of small pox seem to center in the lower back of some individuals. Functional or static conditions explain a large number of backaches especially in women. Here usually ligamentous pull or strain replaces muscular support due to a general or local muscular weakness. Viscerospasm produces a backache in this way but is usually only part of a general condition. The author thinks that gynecological conditions as causes of backache have been overvalued although pelvic inflammations do undoubtedly cause some backache and nearly all lower back pain is aggravated by inflammatory pelvic conditions and the menstrual state. Genito-urinary and rectal conditions are very important and interesting as a cause of backache such as renal stone and hydronephrosis. The pain may be

entirely referred pain due to conditions situated somewhat remotely and in areas supplied by the ilio inguinal ilio hypogastric genitocrural anterior crural and sciatic nerves.

Disease and injury of the locomotor apparatus of the bones joints tendons muscles and associated bursae are a very common cause of lower back pain. Tuberculosis has in the past covered a multitude of joint conditions but numerous other infections are responsible for a great number of conditions diagnosed as tuberculosis. Infectious arthritis plays an important rôle in the causation of lower back pain as do also infections of bone periosteum tendons muscles and bursae. The proneness of the sacro iliac joint to distortion and displacement seems to be due to its markedly limited mobility and its static situation between the trunk and extremities. Tillman recognized the fact that diastasis of the sacro iliac articulation is more frequent than formerly thought and that one sided distortion is often overlooked. The frequency of anomalies in the lumbosacral and sacro iliac regions may be accounted for by the fact that these structures have undergone transition. Gross injury of the spinal column is usually very evident. True dislocation of the sacro iliac joint is perhaps impossible without fracture of some part of the pelvic girdle. Distortion or sprain is quite common.

Due to the fact that the causes of lower back pain are so numerous and associated referred pains are so common a careful clinical investigation should be made before any operative work is undertaken.

E. C. ROOS

Delanay H. The Mechanism of the Circulatory Disturbances in Shock. (*Du mécanisme des troubles circulatoires dans le choc*). *Z. i. chir* 9 8 x 293.

Delanay starting from the proposition that arterial hypotension is the clearest and most constant feature in the condition of shock endeavors to find the causes establishing hypotension especially the mechanism of the circulatory disturbances.

Low blood pressure is shown (1) by the pulse the difference in strength between the humeral and radial pulse (2) by the sphygmometric graph which is of paramount importance as it permits a rapid prognosis indicating the value of treatment and chances of an operation (3) by defects in the venous circulation with abdominal stagnation and peripheral emptiness.

The general circulation in a state of shock is thus so reduced that the tissues are pale and anæmic the extremities cold etc. Hemorrhage is the best known cause of hypotension although its diagnosis is not always easy. Its results are the same as those of abdominal venous stasis viz. deficiency of blood in the large intrathoracic vessels and lung immediate lowering of the arterial pressure and finally anæmic intoxication.

In some cases the heart may fail to adapt its function to the sudden rise of pressure which follows



produced (c) it makes only a slight difference whether this amount is injected in small doses at a time or in relatively large quantities and (d) when the arterial pressure falls but not until then the venous pressure rises.

3. In peptone shock dyspnoea by its suction and force pump action upon the reservoir of stagnating blood in the liver brings more blood to the heart and causes a rise in arterial pressure. By repeatedly inducing short periods of dyspnoea at frequent intervals permanently beneficial results are obtained and the life of the animal can be saved.

4. In experimental fat embolism dyspnoea will cause a rise in blood pressure. But permanently beneficial results have not been obtained by this method. Since Simonds found dyspnoea to bring permanent improvement in surgical shock it is indirect evidence that this condition is not due to fat embolism. Respiratory suction is probably not responsible for the rise in blood pressure in experimental fat embolism. Simonds concluded that the dyspnoea in some way facilitates the passage of blood through the embarrassed pulmonary circulation. Artificial respiration with a bellows will also frequently cause a rise in blood pressure in experimental fat embolism.

5. In peptone shock the respiration is usually not affected although there is some evidence that the respiratory center may be in a state of increased irritability. Simonds further discovered that in experimental fat embolism in some animals a violent dyspnoea develops spontaneously. This is usually accompanied by oedema of the lungs. In other instances an apnoea occurs even before the blood pressure has begun to decline.

GEORGE E. BERRY

## SERA VACCINES AND FERMENTS

Bazy L. Remarks on the Serotherapy of Gaseous Gangrene (*Remarques sur la sérothérapie des gangrènes gazeuses*). *Bull et mém Soc de chir de Par* 1918 xlv 123.

For the past two years Bazy has pursued the study of antgangrenous serotherapy. He thinks the reason that the treatment is not more widely used is because its limitations and applications are not sufficiently understood.

Bazy thinks there is no unique type of gas gangrene but rather several gas gangrenes, the clinical features of which might be differentiated due to the bacillus perfringens, the bacillus *bellonensis*, the bacillus *oedematus*, and the septic vibrio especially each of these germs being capable of evoking a particular form of gas gangrene or rather gangrenous septicæmia, association of the germs not being necessary. A clear classification of the different septicæmias is very desirable. Certain experiments already carried out by Bazy in conjunction with Vallee have established the facts, for instance, that the bacillus perfringens attacks muscle while the vibrio provokes oedema only with subcutaneous phlegmon.

Antigangrenous serotherapy therefore is not aimed against one form of disease but against conditions provoked by different pathogenic agents. There can be no question of a specific serum except in cases where the specific clinical symptoms are known and recognized. The various gaseous septicæmias are toxic affections and those forms of the disease provoked by a single germ must be distinguished from forms due to a multiplicity of germs.

The particularly rapid evolution of gangrenous septicæmia necessitate the use of serum as soon as possible before the appearance of toxic gangrenous phenomena, as the preventive action is always more certain than the curative.

Bazy thinks that in order to be sure of reaching the true agent of gangrenous septicæmia all the germs capable of causing it must be attacked. But it is well to know the relative frequency of the germs. Sacquepe in 57 examinations found the vibrio and the perfringens either alone or associated in about 40 per cent of gas gangrene cases. It should suffice then to use a mixture of sera or better one active serum against the septic vibrio and the perfringens in the majority of cases. A polyvalent serum would be the most practicable as it would furnish the organism with all the antimicrobial and antitoxic antibodies to fight the germs of gangrenous septicæmia. Such a polyvalent serum is available as the result of the researches of Leclanche and Vallee who since 1898 have continuously worked and published their researches on this subject.

W. A. BERNARD

Duval P. and Vacher E. Preventive Antigangrenous Serotherapy (*Essai de sérothérapie antigangreneuse*). *Bull 1<sup>me</sup> Soc de chir de Par* 1918 xlv 1187.

In a bacteriological study of 18 cases of gaseous gangrene of which 13 were fatal the authors found anaerobic microbes as follows: bacillus perfringens 18 times, 13 fatalities; bacillus *oedematus* 6 times, 6 fatalities; septic vibrio 3 times, 2 fatalities; bacillus sporogenes 13 times, 11 fatalities; bacillus *fallax* 1 time, 1 recovery; bacillus *histolyticus* 1 time, 1 fatality.

The bacillus perfringens, bacillus *oedematus*, and the septic vibrio are the most formidable microbes and it is against these three especially that preventive serotherapy must be directed.

The authors' first experimental trials of serotherapy were made in severely wounded soldiers generally by lower limb fracture cases complicated by large vascular lesions and several with incipient symptoms of gangrene. Fifty such cases were selected, 5 of these died within twenty-four hours on account of their condition but did not show any signs of gaseous infection. The others have all been evacuated without development of gangrene. The injections were usually made 5 to 6 hours after injury. Antiperfringens, anti-*oedematus*, or antivibrio sera were used either separately or in some cases combined, 10 ccm. of each kind being used or 30 ccm. of the combination.



value of the various methods of treatment. All the patients were studied in the Medical Clinic of the Johns Hopkins Hospital and were selected serially from the records of the past five years. In every instance the history, physical findings and the blood picture were typical of the so called idiopathic type of pernicious anemia.

An effort has been made to analyze the results of treatment in these cases from a purely objective point of view. Clinical impressions have been disregarded and no attempt has been made to promote or discredit any particular therapeutic measure. It should be recognized that such statistics lead only to general conclusions which allow of exceptions in individual cases. The results may be summarized as follows:

1. No definite evidence has been found that either transfusion, splenectomy or elimination of foci of infection prolongs the life of patients suffering from pernicious anemia.

Transfusion performed at a time when the patient was not refractory brought on remission in about half the cases and enabled the blood count to be raised to a higher level than it reaches in cases not so treated.

3. Such artificial plethoras did not increase the duration of the remission although the patients usually had a sense of well being while the count was high.

4. At other times the same patients were refractory to transfusion as well as to other methods of treatment.

5. The central nervous system symptoms were as little benefited by splenectomy as by other methods of therapy.

6. Transfusion of blood was not held better after splenectomy than before. **GEORGE E. BILBY**

#### BLOOD AND LYMPH VESSELS

**Bridgman E. W. and Hirose K.** The Effect of Diuretics on the General Blood Pressure in Animals with Constriction of the Renal Arteries. *Arch. Int. Med.* 1918, 1: 351.

Since the days of Traube a mechanical explanation for the high blood pressure of chronic renal disease has frequently been advocated. The original theory postulating increased peripheral resistance in the kidney itself as the cause. Failure of ligation of both renal arteries to raise the blood pressure materially was sufficient disproof of the theory in any such simple form.

Various modifications of it have been suggested. Katzenstein obtained a slight rise after incomplete occlusion of the renal arteries and Alvens by compressing the kidneys in oncometers. In spite of the failure to produce any rise in blood pressure at all comparable to the hypertension of human nephritis, the obvious association of hypertension with those types of renal disease in which the renal arterial system is most compromised in the absence of any other satisfactory explanation has prevented the

entire abandonment of the mechanical theory. Furthermore, clinicians have always been impressed with the compensatory nature of hypertension.

The following experiments were undertaken by the authors in the hope of affording further light on the tenability of Traube's theory under conditions of increased functional demand on the kidney. It was thought possible that if the renal artery were narrowed but not occluded and then diuretic substances administered intravenously, the compensatory nature of hypertension might be revealed. Narrowing of the renal artery without obliteration was made possible by the aluminum band of Halsted. The diuretic substances used were sodium chloride, urea and caffeine injected intravenously. In addition the effect of epinephrin was tested. With an aluminum band placed about the renal artery, no increased flow through the kidney can occur as a result of mere local vasodilatation. If any reflex mechanism exists whereby diuretic substances can produce an increased flow through the kidneys under these conditions, a rise in general blood pressure must occur. If on the other hand no rise in general blood pressure and no diuresis follows, then the evidence for this particular view of the compensatory nature of hypertension would be lacking.

The results of their experiments carried out on dogs were negative. They give no support to the view that hypertension in chronic renal disease is a compensatory mechanism brought into play when the renal arterial stream bed is narrowed by chemical or reflex paths to counteract the effect on excretion of the locally diminished blood flow. Their value is only that of negative evidence in general. They do not disprove the compensatory nature of hypertension but show that its demonstration is not to be had by the experimental method employed.

A similar study of animals in whom a constricting band had been left for a considerable period around the renal artery stimulating a chronic lesion would be of interest, but external events prevented the authors from undertaking it. **GEORGE E. BILBY**

**Fiolle J.** Segmental Inhibition of the Arteries in War Wounds (L'innervation des artères dans les plaies de guerre). *Bull. et Mém. Soc. de chir. de Paris* 1918, 44: 996.

In the case of a wounded soldier following a traumatism of the vessel of the upper thigh, Fiolle found the femoral vein sectioned and a peculiar condition of the artery which he terms segmental inhibition. The artery preserved its anatomical integrity; it was hard, reduced in volume and there was no pulsation. Above the level of the trajectory of the projectile the artery was normal. The affected arterial segment was resected but showed no signs of lesion of its internal wall nor any coagulation. It seemed perfectly normal. The only parallel that Fiolle can find is the effect of peripheral sympathectomy described by Leriche. In this there is contraction and usually disappearance of the peripheral pulse but not complete absence of circulation.



This case shows that in war wounds traumatism of the peripheral sympathetic plexus causes segmental contraction of the artery and total or partial suspension of circulation in the vessel. This condition which up to the present time might have been considered a severe contusion of the artery, the lesion of it inter alia with or without intravascular coagulation may only be a simple segmental contraction of the vessel without any lesions of its coatings and without intravascular coagulation. But this matter for consideration is whether this segmental inhibition may exist alone or whether there is a compensating contusion or interruption. Simple inhibition should be treated by recontouring of the peripheral sheath after ligation of the vessel and contusion of the internal rupture by resection.

Finally, that at present there is no means of diagnosing pure inhibition from inhibition with internal lesions. By studying the external aspects of the vessel but the study of the vessel itself they are easily furnished.

The discussion appears to show that the contraction of the artery under operation rather than in the living body is a physiological and that such contraction is essential to the contraction of the vessel and the contraction of the vessel is essential to the contraction of the vessel.

W A B L N

Gadaud F and Jannet G. Osilometry in the Diagnosis of Thrombosis and Encysted Hematomas (L'osilométrie dans les hématomas enkystés). J. de Méd. 1908, 10, 9.

It is often difficult to differentiate between a thrombus and an encysted hematoma. But the necessity of life insurance is not a sufficient reason for the use of the osilometer in the diagnosis of these lesions. The osilometer is not a reliable method for the diagnosis of these lesions.

In a case reported by the author, the osilometer was used to diagnose a thrombus in the femoral artery. The osilometer was used to measure the pressure in the artery. The osilometer was used to measure the pressure in the artery.

With the Pachymeter the blood pressure was measured in the artery. The Pachymeter was used to measure the blood pressure in the artery.

Ransom J. Hemorrhage from an Artery. Folio Sept. 1908, 1, 5.

The author points out that although hemorrhage is almost invariably arterial in character, exceptions do occur and he states that the critical artery has been tested for hemorrhage following a severe throat which autopsy showed to have been due to erosion of the internal jugular vein.

He also describes a case of Dandrige a gun shot wound

of the neck in which the common carotid artery was lacerated for hemorrhage. Autopsy revealed a wound of the vertebral

The author maintains that although this condition is alluded to by all classical authors, the cases are far from common and he regards it as rather remarkable that out of the 57 cases collected by Newcomb from literature extend over a period of fifty years should have come under his attention on one with a quickly fatal result, the other fortunately saved.

He accounts for these diametrically opposite results by the fact that in one case a false aneurysm was formed while in the other the bleeding was so profuse from the moment the artery gave way that there was no time for such formation. He regards the new case as especially interesting because aneurysm of the internal carotid is even of the type that is not intracranial, a very uncommon thing. The internal artery as a side effect by pulling the pharynx is of all rare but the extracranial internal carotid aneurysms are extremely rare. The great artery of this type of case has also been emphasized by Shipley and Linn after a careful search of the literature.

He alludes to Babington's case and only 18 cases of aneurysm of the internal carotid reported in the literature. The common carotid artery is the most frequent site of aneurysm. Matas also maintains that the aneurysms are very rare and are often mistaken for other conditions of the artery. Of cases collected by Weber only 6 were correctly diagnosed.

The author concludes that in the treatment of a carotid aneurysm the extracranial internal carotid artery must be extremely rare in which any other treatment than the tying of the common artery would be applicable. H. J. V. de B.

Tubby A. H. and Banister J. B. Traumatic Aneurysm of the Second Portion of the Subclavian Artery. Operative Treatment. J. L. D. 1908, 9.

A side effect of the middle of the right clavicle in November 1907 by a tiny fragment of shell immediately there a small mass in the middle of the neck was lightly swollen. The swelling subsided for a few days but some difficulty in swallowing and speaking ensued. An x-ray examination showed a minute fragment of metal situated immediately below the clavicle and middle of the neck.

The swelling continued to increase in size and in November 1908 the swelling was as large as the swelling of the subclavian artery. The tumor presented all the signs and symptoms of an aneurysm of the subclavian artery.

Operation was performed November 9. After division of the sternum a very large vessel was found in the jugular vein. This vessel was traced down to its junction with the subclavian vein and both were

adherent to the false sac and were dissected free. In doing so a puncture was made at the junction of these veins and a lateral ligature was applied. The scalenus anticus and phrenic nerves were dissected from the aneurismal sac and retracted outward. The upper end of the aneurism was ligated. The clavicle was divided at the middle and its inner half turned inward.

In clearing away the structure on the outer side the sac gave way and a great gush of blood followed which was controlled by pressure with the finger. A ligature was placed around the subclavian artery distal to the aneurism; the clavicle replaced the muscles and wound closed. The operation lasted two and one-half hours; the patient died the same day.

At autopsy there was a hole the size of a pea between the ligatures on the anterior aspect of the artery made by the fragment of shell.

V. C. HUNT

**Okinczyk J.** Vascular Wounds and Their Immediate and Late Complications in War Surgery (*Les plaies vasculaires et leurs complications immédiates et tardives en chirurgie de guerre*). *J. de chir. Par.* 1918 xiv 441.

In operating upon 60 successive cases of wounds of the face, neck, and limbs the author found 53 with associated vascular wounds. Some of these were multiple vascular wounds; the total number being 79 or about 36 per cent. The radial, tibial, humeral, and popliteal vessels are most frequently found injured.

The association of arterial and venous lesions is the rule, especially in vessels of medium caliber and in the limbs where an artery is flanked by two anastomosing veins.

The factors which particularly disturb the evolution of vascular wounds are concomitant nerve lesions and injuries of the soft parts, both of which affect the establishment of collateral circulation; the general state, i.e., a condition of anemia is also an important factor.

Ignored vascular injuries, i.e., the so-called dry vascular wounds, tend to become less frequent thanks to the general practice of early opening up of war wounds and especially the extensive excisions which lead to the discovery of such lesions. The capricious trajectory of a projectile and the absence of primary hemorrhage or hæmætic swelling frequently hide an important injury of one of the larger vessels. Exploration of the vessels and the vascular region for these dry wounds should be a clinical and operative routine.

The indications for such a search are given by (1) the trajectory of a projectile crossing a vascular line; (2) the radioscopic examination which localizes a projectile in or near a vascular region; (3) spontaneous or provoked pain in a vascular tract. This pain can very often be exactly localized and it is all the more remarkable because apart from fractures war wounds are not in general immediately spontaneously painful.

Regarding treatment, when an important vascular lesion is found despite the fact that Makins and others have shown much more favorable results from simultaneous ligation of artery and vein than from ligation of the artery alone, Okinczyk is not convinced of the absolute advantage of this method. While he never observed gangrene following quadruple ligation in old arteriovenous lesions, in 7 cases of simultaneous ligation of vein and artery for recent lesions he found massive gangrene in 3 and partial gangrene in 1. The time elapsed since injury in these cases was from four to fifteen hours.

Okinczyk thinks that vascular suture is the procedure of choice when circumstances permit. Unfortunately, circumstances frequently limit its application as time and the patient's condition are the important factors. The operation is long and difficult and the suture must be done in absolutely healthy vascular tissue. While satisfied that arterial intubation has many indications, the author has not had the opportunity to practice it.

He gives histories of 20 cases of arterial and arteriovenous aneurisms which he treated. These were secondary to untreated vascular lesions, the time elapsed since injury varying considerably, running from a few days to a couple of years. In the case of arteriovenous aneurisms the procedure was quadruple ligation supplemented by ligation of collaterals when necessary and extirpation of the aneurism in arterial aneurisms, double ligation and extirpation. There was only 1 death, an operation of urgency in a desperate case and no recurrences nor disturbances in the circulation were noted. W. A. BRENNAN.

**Le Fort R.** How the Large Vessels React to Old Projectiles Lodged Within or in Contact with Their Walls (*Comment se comportent les gros vaisseaux vis à vis des projectiles anciens inclus au contact de leurs parois*). *Bull. Acad. de Méd. Par.* 1918 lxvix 443.

The elastic tissues of the large vessels easily arrest spent projectiles. Although it is common to find projectiles embedded in the vascular sheath yet hemorrhages arising from this are rare. A careful examination of cases establishes the fact that a projectile only invades or perforates a vessel when the vessel cannot escape from it, which rarely happens when a projectile is small in size.

Secondary or late vascular ulceration about a projectile is almost always a septic phenomenon as bullets, etc., even though well tolerated for a long period preserve microbes on their surface which set up infective processes in their neighborhood. This is the cause of the hæmoptysis which carriers of old pulmonary projectiles show.

There are three methods of defense of the vessel against such dangers, according to Le Fort: (1) a part of the circumference of the vessel and the projectile are surrounded by and embedded in sclerous connective tissue, this commonly occurs in veins, more rarely in arteries; (2) in the case of arteries usually the projectile becomes embedded in a more

or less thick scleous tissue separated from the elastic layers of the artery by a cleavage plane which acts as a serous bursa and obviates friction it is a admirable protection (3) a small projectile may be embedded in a thickened arterial wall preventing a soft adventitia and free adhesions to the sheath

These methods of defence are effective not alone against hemorrhage but also in preventing the vascular function. Neither thrombosis nor arterial occlusion are more frequent than delayed hemorrhage. Local partial penetration of a projectile into the lumen of a vessel should be eryrerespecially in old cases. It may be seen of course in the case

It is well to be reminded of these facts in mind when seeking indications for the removal of a projectile in the vicinity of blood vessels. The pulsation of a projectile embedded in the tissue is not of itself an indication for operation.

W. A. BRANNAN

### POISONS

Speed K. Recurring Tetanus. *Medical Surgeon* 98 499

The author reports an interesting case of recurring tetanus in a patient reported in the field ambulance journal 1908.

Eight days before the patient suffered from pain in the back and a few days later he had difficulty in opening his mouth. He had sustained no wound had no abrasions, ulcer anywhere on the body nor had he bitten his feet. His temperature was 98.1 and his pulse a 70. A professional diagnosis of tetanus was made and he remained at the general hospital January 5-9. On addition of stiffness and rigidity of the neck and thigh muscles. His tendon reflexes were present and normal and he could open his mouth about half an inch.

At the field ambulance he had been given 300 units of antitetanic serum in January 2 at the base he received 1500 units every day for one week.

On inquiring into his past history it developed that he had been wounded August 15, 1906. His wound consisted of a lacerated area on the inner side of the left knee which was not operated upon at the time. His first injection of antitetanic serum had been nine hours after the injury a second dose followed while he was in France.

On August 4 he arrived in England and received the third dose of antitetanic serum. In September his wound as reported as clean and healed.

On October 9 he complained of a pain in the back and difficulty in opening his mouth. A diagnosis of pseudotetanus was made and another 1000 units of antitetanic serum were given him on October 25. On October 30 the mouth spasms became more marked accompanied by cyanosis and profuse sweating and he developed a foul sloughing ulcer on the left side of the tongue. On the night of the 31 a diagnosis of tetanus was made and 3000 units of serum were intravenously injected under chloroform anesthesia. His temperature at that time was 99°F and his pulse 98. He is described as

sitting propped up in bed his head drawn back and with the back somewhat arched and the muscles of the back of the neck and spine in a state of tonic contraction. The masseter muscles were also in spasm but the mouth could be opened a very little.

The abdominal muscles were contracted and hard and the left hip was forcibly flexed with tonic contraction of the left hamstring muscles and the left gastrocnemius. Plantar stimulation produced violent spasms of the leg muscles which spread to the muscles of the lumbar spine. Upon tapping the patellar tendon there followed a short but violent spasm of the quadriceps extensor of the thigh. Ten hours after the intravenous injection of the serum he was again anesthetized and specimens of blood were taken from the arm and cerebrospinal fluid withdrawn by lumbar puncture. Recovery which was slow in character but practically complete followed and he was discharged for duty on February 1, 1908.

Experiments were carried out on guinea pigs and proved beyond doubt that the tetanus toxin in the blood was neutralized and that the patient contained both in the cerebrospinal fluid and in his blood an excess of free antitoxin.

The case has several features of interest. There was a long period of incubation. The symptoms came on slowly and insidiously and the diagnosis remained in doubt for a long period. The symptoms gradually became more definite and the condition was ultimately typical of a severe type. A single large dose of antitoxin injected into the vein resulted in a satisfactory cure.

At the time of his second tetanic attack the old wound was not x-rayed for the possible presence of a foreign body but the author explains that this was done later and a foreign body found which was removed. Whether or not this will have any influence on future attack in this patient's case will be interesting to note. Consideration as given to the fact that it might have been a tetanic case. He probably had been regular he had no opportunity of note in his diet unwashed vegetable.

Failing access to the literature on the subject and handicapped by the lack of complete laboratory facilities which might lead to scientific study of a case such as this patient presented it is necessary to limit him lest without further study.

The author believes that if any foreign body remains in the wound no matter how small it should be removed and should symptom ever appear again the search for the original wound should be delayed until some harbor bacteria for years.

E. C. ROBERTS

### ROENTGENOLOGY

M. K. Nield and Knicker St. R. scopi Rad. g. am to illustrate the Anatomy of the Temporal Bone and Partially the Fallopian Canal. *Medical and Surgical Journal* p. 918 8

Stereo copier roentgenograms of the temporal bone were made with a wire in the fallopian canal in

order to illustrate the relationship of the cranial to the other constituents of the bone. Temporal bones in adults in children at the age of eleven years and a birth are illustrated and detailed descriptions accompany them. **ADOLPH HARTUNG**

Eisen P. Application of the X Rays in Defining and Studying Kidney Tumors. *Am J Urol* 1918 13 9

The author has examined a large number of kidney tumors by means of the roentgen ray with definite findings in all those which were palpable. The size and shape was generally shown as well

as the presence of calcareous deposits. Insertion of a shadowgraph catheter and the making of stereoscopic plates assisted in the localization. Where fistulous sinuses were present injecting them with bismuth paste and examining stereoscopically was of distinct value in determining their point of origin. Iyelograms also gave much information especially if stereoscopic exposures were made. Injection of an opaque enema showed the relationship of the colon to the tumor mass and permitted of definite conclusions as to the origin of the tumor mass by virtue of the displacement it caused and noting where it lay. **ADOLPH HARTUNG**

## MILITARY SURGERY

**NOTE** — Readers are referred to the Table of Contents for other articles dealing with military surgery which appear under the various headings according to our anatomical arrangement.

McMurtree D. C. Reconstructing Crippled Soldiers of France. *Am J Urol* 1918 13 840

The author regards the medical and surgical treatment given wounded soldiers as only the first step in the process of reconstruction and believes that this work can only be completed when the soldier has been made into a capable self-supporting worker and his self-respect and happiness which can only come through useful activity be restored.

He gives a somewhat detailed account of the French reconstruction methods and make special mention of Edouard Herriot, mayor of Lyon who was the first to propose serious vocational training and who opened the first municipal school for disabled soldiers in December 1914 with an enrollment of but three pupils. Today there are over one hundred such schools. The importance of this work was soon recognized by the French Government and in March 1916 a National Office for Disabled and Discharged Soldiers was created.

The author regards the plan adopted by this bureau as a most excellent one. They have established a center of re-adaptation in every part of France to which can be sent men native to that region and where when practical trades are taught that are peculiar to that locality. Each complete center of re-adaptation should include (1) a hospital of physiotherapy where the invalid receives functional re-education or the treatment which will give him back the greatest possible use of his muscles (b) an apparatus center where artificial limbs and other appliances are manufactured and distributed and (c) a center of vocational re-education.

The author believes that in all well planned re-educational work there should be an investigation of the state of the industry before any trade is offered as an occupation and that not only the nature of the disability should be considered but also the patient's general health, his native intelligence, his schooling and his adaptability. He believes whenever possible

he should be given some work connected with his former trade so that he can reap some advantage from his previous knowledge and skill.

**H. J. VAN DEN BERG**

Geist E. S. The School of Clinical Military Orthopedic Surgery. *Am J Orthop Surg* 1918 11 483

The school is located at Camp Greenleaf. The objects of the school are as follows: (1) the making of intelligent assistants for foreign and domestic service (2) the making of efficient camp orthopedists (3) the making of efficient base hospital orthopedists (4) furnishing a groundwork for future training in orthopedic surgery in other centers.

The duration of the course is four weeks of intensive instruction. After their arrival at Camp Greenleaf the medical officers are first given a four to six weeks course of training in those subjects which it is necessary for every military medical man to know such as drill, physical training, military hygiene, etc. During this time those most fitted for orthopedic surgery are assigned to the orthopedic course. A new class of 25 is admitted each month.

Orthopedic surgery has the following points to solve in the war: (1) helping in an orthopedic way to make the army fit for service (2) helping to keep it fit (3) treatment and reconstruction of the wounded and disabled. The presence of a large body of troops at Chickamauga Park has made it possible to effectively teach the first two subjects and as yet there has been no clinical material from the war to teach the last phase. It is hoped that the school will soon have access to a large reconstructive hospital. The clinical material now accessible is of the peace time variety.

The central theme in these courses is prevention of deformity. Anatomy, especially bone joint and epiphyseal anatomy, together with functional muscular anatomy and the distribution of the peripheral nerves is absolutely demanded. Every student officer

er is required to make nearly every splint in Manual No. 4. Wire is used as the basic material chiefly. They are also taught deigning braces. A course in foot ailments is given. Current orthopedic literature is abstracted and discussed.

In the February class original articles appearing in last year's literature were abstracted. A review of bone and joint pathology including healing of fractures is given. The orthopedic material consists of 75 to 100 and patients with a number of outpatient clinics. Class No. 4 is no longer instructed. Operative instruction has been negligible. The number of operative cases has been very small.

III. LAND

Forgue F C ncer and tl War (Le e t fa  
g err ) B ll A d d d P r 9 8 1 84

Although traumatism is the most powerful factor capable of developing cancer yet critical evaluation shows that a traumatism of itself cannot cause cancer. In a healthy organism the rôle of traumatism is limited to accelerating or aggravating a pre-existing tumor or making a latent tumor manifest.

Statistics of the war show that most frequently are maxillary results from a single and abrupt trauma while episthoma results from repeated and chronic irritations. Such are the cutaneous irritations due to exposure the chronic inflammation of old scars and fistulous tracts and the irritation of the mucosæ by alcohol tobacco bad teeth syphilis etc.

In the French Army the number of claims for pensions arising from cancer cases since the onset of the war has been relatively small. In 1900 500 soldiers less than 500 have had cancer as the basis of the claims. More than half of the cases are cancer of the digestive tract and can be of the stomach in the first rank.

With regard to age the conditions of war have

neces stated the draftin of men up to the fift eth year. The proportion of cancers in young men up to the thi tieth year is small from the thirtieth to the th rty fifth year the frequency i rpled from the thirty fifth to the fortieth year the fig e doubles again the maximum frequency is found from the fortieth to the fiftieth year and half of the total claims are from men of th s age

While formerly it was the rule to exclude any connection between the incidents of army service and cancers a more benevolent view is now taken trauma in defective alimentation and even fatigue being admitted as contributing factors and the claims being disposed of accordingly. Hence responsibility has been admitted in more than half of the total claims for compensation. W. A. BRENNAN

Alig Don	c	Delay at	d	Pr	mary	Suture	of	War	Wounds
(L	t	p	mt	v	t	dé	d	s	plu
d	f	t	B	ll	t	t	S	d	l
1		76							

Algla e reports 5 cases of war wounds which had been operated upon and dressed at the front but were for some reason evacuated to interior hospitals without being primarily sutured. Algla e stated these wounds without bacteriological control being directed solely by the clinical aspect of the wound and the apparent condition of the patient.

The suturing has been done 17 cases after five days in 3 cases after six days in 1 case after seven days in 7 cases after eight days in 4 cases after nine days the others being done up to 14 days after the primary operation

In most cases the wound were sutured without the use of an anesthetic. The results were good in all cases. There were no failures. W. A. BRENNAN

# GYNECOLOGY

## UTERUS

Macfarlane W D Uterine Fibroids or Myomata of the Uterus Complicating Pregnancy Labor and the Puerperium *Glasgow M J* 1915 11 257

In 13915 consecutive cases of labor reported by Pinard only 0.6 per cent were complicated by uterine fibroids. There may be various changes produced by pregnancy on such a tumor. The pedicle of a subserous fibroid may become twisted due to the softening of the uterine muscle and torsion of the uterus on its cervix has been recorded. Pregnancy may cause a very rapid increase in growth of these tumors which may become impacted in the pelvis. Fibroids also undergo changes in shape due to the pressure of the growing ovum.

Fibroids frequently produce abortion due to the hemorrhagic change of the endometrium associated with myomata. When situated on the posterior wall of the uterus such a tumor may produce a retroversion leading to an incarceration of the gravid uterus.

Expectant treatment is all that is required in most of these cases. If operative treatment for the tumor is undertaken premature labor is likely to result. Operative treatment must be carried out if there be present pressure symptoms, torsion of the pedicle or of the uterus, degeneration of the tumor or if it is apparent that the tumor is so situated that the child cannot be born by the natural passages.

Considerable bruising of the tumor may result and sepsis intervene from instrumental interference or from pressure of the child's parts. The tumor in turn may cause obstruction of delivery, malpresentation or hemorrhage and these complications must be dealt with as they arise.

Several cases illustrating various complications are reported by the author. He says in conclusion that uterine fibroids complicating pregnancy do not necessarily cause difficult labor but the knowledge of their presence should keep the medical attendant alive to the fact that operative treatment may be required in place of the usual expectant method.

C. C. POOS

## ADNEXAL AND PERIUTERINE CONDITIONS

Corcia J Report of a Case of Papillary Cystadenoma of the Ovary Without Recurrence After Seven Years *Am J Obst N Y* 1918 17 111 6

The author here reports a case which appeared to be quite hopeless at the time of operation. The peritoneal cavity containing about five gallons of

clear liquid and an extraordinary number of cysts of different size surrounding a central larger cyst. Numerous papillomata extended from these cysts into the peritoneum, intestines, bladder and to the opposite ovary. This patient is reported as enjoying good health seven years after the operation.

The author accompanies this report with a brief summary of the recent literature. As a result of this study he concludes:

1. Papillary cystic growths must always be considered clinically malignant because their outcome is not known but operation may give unexpectedly good results.

2. Early operation is always desirable when a diagnosis of cyst is made.

3. In the advanced state when there is ascites and great emaciation of the patient the diagnosis of cyst is difficult if not impossible being confused with a general cancerous or tuberculous affection of the abdomen.

CAREY CULBERTSON

Schwartz L S Papillomatous Cysts of the Ovary with a Report of 11 Cases *Am J Obst N Y* 1918 17 111 79

Accompanying a brief review of the literature covering the etiology and pathology of papillomatous cysts of the ovary, Schwartz presents a protocol of twelve cases which have been operated upon since 1910. Of these cases three died following the operation, one died two months after, one three months after and one six months after operation. The subsequent record of one could not be obtained. Of the remaining five all are living and well two seven years, one four years, one thirty months and one eighteen months after operation.

The author regards total extirpation of the uterus and adnexa as the ideal procedure and considers the prognosis more favorable than is usually believed. Even incomplete removal of the growth with proper drainage may be followed by complete recovery and repeated operations for recurring growths are of a certain value. Examination of the ascitic fluid as bearing on prognosis and treatment is regarded as well worth while.

CAREY CULBERTSON

Polak J O A Further Study of the End Results of the Conserved Ovary *Am J Obst N Y* 1918 17 111 99

This second report made by Polak is based upon a study of the pathology found in 13 reoperations for clinical suffering and subsequent disease in the retained ovary. For the sake of comparative study cases have been selected where the uterus and one or both ovaries have been retained after extirpation of the tubes as well as those cases of hysterectomy in

which the conserved ovary as retained in the tube retention of the tube during a more perfect ovarian circulation. Where tube is removed at the first operation great care had been taken to preserve the afferent and efferent circulation of the ovary by dividing all the branches of the uterine plexus. Where the uterine remnant at the primary operation the uterine artery had been ligated to prevent the anastomosis that runs in the ovarian circulation as a collateral artery.

Polak reports that he has 3 men who have been operated upon for painful and cystic ovaries within a year of the previous hysterectomy. The judgment is that the hysterectomy is not a fault. He is completely satisfied with the result that routine cases require the hysterectomy. The ovaries have been removed. The hysterectomy is not a fault.

He reports the following conclusions: Routine hysterectomy is not a fault. The hysterectomy is not a fault. The hysterectomy is not a fault.

Regard the hysterectomy as a routine procedure. The hysterectomy is not a fault. The hysterectomy is not a fault.

3. Even when the hysterectomy is performed, the ovaries are not removed. The hysterectomy is not a fault.

4. Without the uterus, the hysterectomy is not a fault. The hysterectomy is not a fault.

5. The life of the hysterectomy is not a fault. The hysterectomy is not a fault.

6. A cured patient has been cured. The hysterectomy is not a fault.

### EXTERNAL GENITALIA

Abbott A. W. A. T. F. L. V. G. N. A. U. L. N. G. A. S. N. G. L. P. O. T. O. N. O. F. I. L. U. M. S. C. O. H. I. 9. 8.

All reported cases to date. The hysterectomy is not a fault. The hysterectomy is not a fault.

through the vulva and a single limb of the ileum in stead of the loop.

The advantages of using one limb of the intestinal loop instead of both are (1) it takes less of the bowel (2) it requires the closure of only one end of the utilized limb instead of both ends of the loop and (3) a second operation to divide the septum between the leg of the loop is unnecessary. The operation is complete in one sitting.

### MISCELLANEOUS

Sperry J. A. R. S. L. F. O. L. L. O. N. G. O. P. E. R. T. T. R. E. A. T. M. E. N. T. O. F. P. E. L. I. C. I. N. F. L. A. M. M. A. T. O. R. Y. D. I. S. E. A. S. E. I. N. T. H. S. T. A. N. F. O. R. D. U. N. I. V. E. R. S. I. T. Y. C. I. N. C. I. F. S. I. F. I. D. O. 9. 8. 38.

The hysterectomy in the Stanford Women's Clinic how long of pelvic inflammatory disease operation. The hysterectomy in the Stanford Women's Clinic how long of pelvic inflammatory disease operation. The hysterectomy in the Stanford Women's Clinic how long of pelvic inflammatory disease operation.

The hysterectomy in the Stanford Women's Clinic how long of pelvic inflammatory disease operation. The hysterectomy in the Stanford Women's Clinic how long of pelvic inflammatory disease operation.

A great number of backache cases have been treated with hysterectomy. The hysterectomy is not a fault.

On the other hand, the hysterectomy is not a fault. The hysterectomy is not a fault.

In the hysterectomy, the hysterectomy is not a fault. The hysterectomy is not a fault.

In the hysterectomy, the hysterectomy is not a fault. The hysterectomy is not a fault.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Blair P.** The Permanent Hypotensive Action of Blood Letting in Eclampsia (De la ténacité hypotensive de la ligature de l'impie gravidique) *C. p. d. S. d. biol. I. r.* 9 8 l. vii 78

French obstetrical practice has always utilized blood letting as a heroic method of treating eclampsia. In studying the evolution of oscillographic values in obstetrical variation has been noted following blood letting in the course of eclampsia and the severe albuminurias of pregnancy.

The author gives a tabular statement of the most complete of the observations. The results show that blood letting in eclampsia causes an immediate and lasting fall in the maximum and minimum oscillographic values. The amount of the fall does not depend on the quantity of blood withdrawn. In the cases which the author reports the immediate fall in pressure was regularly continued during the days following. The immediate reduction of tension shows the diminution of the work of the heart.

Contrary to older ideas blood withdrawal of a medium grade 500 grams suffice in eclampsia to cause an immediate and lasting fall of the arterial pressure in elevated hypertension of the renal type as well as a diminution of the work of the cardiac muscle.

This permanent hypotensive action fully justifies the confidence which obstetricians have always placed in blood letting as a treatment of eclampsia.

W. A. BRENNAN

**White C.** Nephrotomy Combined with Cesarean Section in the Treatment of Eclampsia with Suppression of Urine. *B. t. W. J.* 9 8 ii 4

The indications for cesarean section are the occurrence of convulsions or the onset of severe toxemic symptoms in a primigravida with an undilated cervix especially if little urine is being excreted and if generalized edema and cyanosis are present. The advantage of cesarean section in such cases is that the rapid method of delivery per vaginam is possible except in the case of local trauma and shock that exceed that of laparotomy. After cesarean section the eclamptic seizure rapidly improves in the great majority of cases but in some there is difficulty in eliminating the toxin owing to more or less marked suppression of urine.

To ascertain the state of the kidney during an eclamptic attack in patients with a diminished output of urine the author has palpated the kidney directly through the abdominal incision after performing cesarean section in eclamptic patients. In every case he has found the organ swollen tense and in some cases as hard as stone. Whatever the

pathology of the condition increased intracapsular pressure certainly has been present in the cases in question and this is a very important factor in causing suppression of urine. It may be the only factor of vital importance in some cases of acute inflammation of a previously healthy kidney. If increased pressure inside the fibrous capsule of the kidney be the cause of the suppression it may act through alterations in the blood flow or by pressure on the tubule leading toward the ureter. Of the two the latter seems to be the more probable mode of action.

If increased intracapsular tension be the cause of the diminished flow of urine and if the diminution in the quantity of urine passed is sufficient to cause delay in the excretion of the toxin causing the nephritis the indication is to relieve the hypertension before degeneration of the renal epithelium takes place and the terminal thrombosis of the intertubular vessel occurs. Cesarean section for eclampsia is one of the few conditions in which this can be done easily as at this time the operator is faced with (1) acute inflammation of a previously healthy kidney (2) general toxemia causing that inflammation and (3) a laparotomy incision giving easy access to the kidney. Since the renal tension is very frequently raised it has become routine to treat suitable cases by nephrotomy after doing cesarean section. Such suitable cases are uncommon even in a lying-in hospital yet the results as regards immediate free diuresis have been good and uniform as every patient in the author's experience (six in number) has passed a large quantity of urine from the time of operation.

Suppression of urine in some cases of pregnancy toxemia is caused by pressure on the collecting tubule due to increased tension inside the fibrous capsule of the kidney. It can be treated successfully by nephrotomy after symptoms have persisted for many days. As a prophylactic measure nephrotomy may be combined with cesarean section advantageously in suitable cases. EDWARD L. CORNELL

**Reed C. B.** The Induction of Labor at Term. A Supplemental Report. *S. g. G. J. Obst.* 1918 vii 163

In the present series there were 31 primiparae and 49 multiparae. The average duration of labor was 9 hours and 8 minutes. This figure is greater by 53 minutes than the average in the first series but it may possibly be accounted for by the presence of 16 more primiparae in this series.

The longest labor was 8 hours the shortest one hour. The shortest labor in a primipara was 1 hour and 25 minutes.

The bag broke during or shortly after insertion





being five instrumental deliveries. One of these however was in a case of eclampsia leaving four of low forceps delivery due to delay at the outlet i.e. in 10 per cent of the cases a very high percentage for the hospital. There were no stillbirths but one infant restored after artificial respiration for twenty minutes died seven hours later. One required artificial respiration off and on for two hours before natural breathing was fully established. Five were blue and did not breathe at once but were easily restored though one of them had an alarming attack of cyanosis on the second day.

From St. Bartholomew's Hospital 20 cases were reported. The smallest number of injections given was three, the large 14 and the average 6.2. One hour after the administration of the initial dose 1/450 gr. of scopolamine was given and twenty minutes later an object with which the patient was not familiar was shown to her. The memory test is a safe guide but not an absolutely reliable one for there are instances in which apperception is present throughout but amnesia is complete. The pangs of the first stage were apparently unaffected in 13, became stronger in 3 and weaker and less frequent in 4. It is worthy of note that out of the four patients in whom the pains became weaker three were multiparae. In the absence of uterine inertia little effect was produced upon the strength, frequency or duration of contractions in stage one.

The second stage was distinctly prolonged especially among the primiparae. This was due to the lack of voluntary expulsive efforts on the part of the patient but in three patients there was also a weakening of the uterine contractions. When neither mother nor child showed sign of distress the second stage was allowed to continue for five or six hours but in spite of this eight out of the four teen primiparae failed to deliver themselves spontaneously, seven children were extracted by forceps and one by traction on the breech. Of the six multiparae five were delivered spontaneously and one by forceps. The average duration of the second stage in the primiparae was four and a half hours. In the multiparae it was one hour and thirty five minutes.

The third stage of labor was prolonged the average duration being fifty five minutes. There was no severe postpartum hemorrhage during the third stage. There was a temporary relaxation of the uterus four or five hours after delivery in three cases. In 25 per cent there was no amnesia and the whole course of the labor was clearly remembered.

Most twilight sleep babies were born in a condition of oligopnoea and although it appears alarming the condition is transient and need not cause anxiety. No special treatment is required beyond covering up the child and keeping it warm. In three cases and these were all forceps deliveries there was a condition of true white asphyxia the child was deathly white its muscles flaccid the reflexes absent and the heart acting feebly. Under the treatment described all these children recovered.

The puerperium and period of recovery was not affected adversely by the injections. In the majority of cases the pangs of childbirth were materially lessened and in more than half the cases the memory of the greater part of the labor was completely obliterated. The duration of labor was lengthened and the proportion of instrumental deliveries increased. No serious adverse effects were produced upon the mother excepting that there was some tendency to relaxation of the uterus after delivery but not sufficient to cause anxiety in any case.

In St. Thomas Hospital 80 cases were specially observed, 60 were primiparae and 20 multiparae. The number of injections varied from 1 to 19 the average being 6.5. In the primiparae the average was 7 in the multiparae 5.5. The memory test proved quite useful. The notice the patient took of the prick of the hypodermic needle was found to be more useful than the memory test. It was found that the injection due two or three hours after the first could often be omitted. Five per cent of the cases may be reckoned as complete failures. In 95 per cent some relief from the pangs of labor was obtained in 77.5 per cent some degree of amnesia and analgesia was present and in 45 per cent complete amnesia and analgesia.

There seemed to be a tendency to delay in the latter part of the second stage and this was shown by an increase in the number of forceps deliveries. Pituitary extract was also given in eleven cases before the birth of the child the rule being that if delivery did not follow its administration within half an hour extraction by forceps should be carried out at once. Of these eleven cases delivery resulted within a short interval in five. In the other six cases two of which were unreduced occipitoposterior positions delivery by forceps followed and in four other cases delivery by forceps was done without any preliminary injection of pituitary extract. There were thus ten cases of delivery by forceps or 12.5 per cent which is about four times the average in the ward of cases in which this operation is done for delayed second stage.

The placenta was expelled spontaneously by the patient's own efforts in 41 cases and was expressed after expulsion from the uterus in 39 cases. Bleeding was stated to be greater than usual in 9 cases. In four the bleeding was described as postpartum hemorrhage. Three stillbirths or 3.75 per cent occurred two of which were due to causes quite independent of the narcotism. In 20 cases (23.75 per cent) the child did not breathe nor cry spontaneously at birth but in nine of these the delay was so trifling as to be scarcely worthy of notice. There were ten cases of instrumental delivery — one multipara, nine primiparae.

The principal disadvantages attending this form of narcosis are those which may be expected from any form of anesthesia — the prolongation of labor the tendency to delay retraction in the third stage and to sluggishness of the infant in starting respiration. These effects can be judged from the evidence



# GENITO URINARY SURGERY

## KIDNEY AND URETER

Gayet. Projectiles Embedded in Kidney Tissue. Urinary Fistula. Nephrectomy and Recovery (Projectile intrin aux haine urinaire. Nephrectomie guérison). *L'opérateur* 1918. n. 311

It is rare for a projectile to remain in the soft kidney tissue. There is no resistance offered to the passage of the projectile and hence perforation, fissures or ruptures of the organ are more usually met with as the result of war traumatism. The author relates a case in a soldier who was wounded in the left lumbar region by shell fragments. After the preliminary treatments three lumbar fistulae persisted. Radiograph showed three pieces of projectile in the inferior and superior ilio-lumbar regions. Urine was noted escaping through one fistula.

Under screen control after a vertical paravertebral incision the largest piece of projectile was extracted further radioscopy showed that the smaller projectiles were intrarenal one projectile was in the capsule and the other in the extremity of the superior calyx. They were extracted by splitting the kidney. The further developments of the case were stated a nephrectomy some months after the extraction of the projectiles from the left kidney. The man made an excellent recovery.

The reason for the failure of the extraction operation in this case was the fact that there was a third particle of projectile in the kidney which the radioscopy screen examination did not reveal at the time of extraction of the other.

The author calls attention to the rapid alterations which the kidney showed following the presence of these foreign bodies shown physiologically by the fall in urinary functional results and anatomically by sclerosis and small military abscesses. These changes show the necessity for a rapid intervention in cases of intrarenal projectiles since they have a most pernicious action on the neighboring parenchyma somewhat analogous to but more rapid than that due to kidney calculi. W. A. BRENNAN

Marmol D. G. Malignant Hypernephroma of the Kidney. Successful Metastases in the Humerus and Femur (Hypernephroma maligno del riñon metastasizante en el humero y femur). *Archivos de cirugía* 1918. n. 11. 8

The patient was a man fifty years old who was operated upon for a renal tumor. The lumbar nephrectomy incision was used but was made 10 cm. long owing to the size of the tumor. The post-operative course was satisfactory the patient leaving the hospital after a few weeks. The tumor weighed 420 gr. It was 3 cm. long and 1.5 cm. thick

at its superior pole. Histologic examination showed it to be a typical malignant hypernephroma.

Six months later the patient returned to the hospital complaining of acute pains in the left shoulder joint which was swollen and very sensitive to pressure. The epain began about two months after operation. A very careful examination showed all the symptoms of osteosarcoma and the patient consented to a radical operation. An interscapulo-thoracic amputation therefore was done. Sarcomatous invasion had destroyed the capsule and invaded the joint.

The patient passed one and a half years in excellent health. He then suffered a bad fall which fractured the lower third of the femur and he came to the hospital for treatment. After two months pseudarthrosis developed with a very disproportionate exuberance of callus. The symptoms were ultimately diagnosed as sarcomatous development at the site of fracture. The thigh was amputated at its upper third. The man survived the operation for two years then showed new metastases and died.

The author thinks the theory that these hypernephromata are of sarcomatous origin is reasonable inasmuch as they are disseminated by the venous route and not by the lymphatics. Metastases are most usually observed in the lungs the liver and large bones. W. A. BRENNAN

Geraghty J. T. and Frontz W. A. A Study of Primary Hydronephrosis. *J. Urol.* 1918. n. 6

The authors state that the object of this study was to determine the factors responsible for the development of the so called primary condition.

They do not wish it to be understood that vascular anomalies are never the primary cause of hydronephrosis but they are of the opinion that to assign to the anomalous vessel the chief credit for the production of the obstruction is in the majority of cases merely the confusion of cause and effect for in exposing kidneys which are the seat of other diseases they have frequently seen vessel occupying positions identical with those described as productive of obstruction without having occasioned suggestive symptoms or altered the size of the pelvis.

In the cases of renal mobility giving a history of repeated attacks of colic which they were able to observe there has never been a definite hydronephrosis except in those instances in which other factors co-existing and definitely obstructive would offer a valid explanation. If renal mobility can produce hydronephrosis the kinking of the ureter must be assigned as the cause and it has been shown experimentally that a very acute permanent kink can be produced by suturing the wall of the ureter without producing any change in the renal pelvis.

The reason the able kidney is assigned a so frequent a cause of hydronephrosis is due to the fact that enal mility is frequently secondary to hydronephrosis and secondly to a failure to recognize the more potent although less evident cause of obstruction occurring either coincidentally with movable kidney or long preceding it in point of time.

The authors state that congenital renal malit is whether they occur in the ureter or elsewhere are frequently cited with other defects and they believe that when hydronephrosis is associated with multiple ureters the hydronephrosis can not be explained on the basis of ureteral multiplicity but that it has been produced by their concomitant defect which actually produces an obstruction to the outflow of urine of the abnormal malit in ureteral caliber are probably the most important.

In the case of hydronephrosis in which the authors consider it advisable to do a nephrectomy rather than any plastic procedure a pathologic study of the ureteropelvic junction disclosed that in all the cases examined excepting one the hydronephrosis was definitely the result of inflammation and regarding the true nature of the obstruction being revealed by careful microscopic study of this region. In the case of the cases a marked increase of connective tissue just beneath the mucosa and only a very careful examination revealed a few areas of undifferentiated and thus proving its inflammatory origin.

They say that it is well known that a contraction in the lower portion of the ureter may cause a slight if any hydronephrosis whereas if the true degree of contraction be present at the ureteropelvic junction a marked and rapidly developing hydronephrosis could result.

The author claims that diagnosis is comparatively easy yet a demonstration of the causative factor may be considerable difficulty and in certain number of cases it must be made by elimination. In certain instances a definite narrowing of the upper ureter may be demonstrated by ureteropyelography and in cases where an aberrant blood vessel plays a role in the obstruction a kink in the upper ureter may be found. In other cases calculus tuberculosis and tumor must be eliminated. They emphasize the fact that a diagnosis occurring at the ureteropelvic junction usually is secondary to inflammation by processes. Hunner method facilitates the recognition of a certain number of cases in the female particularly in which the case is a considerable cause of secondary hydronephrosis in many cases it is not successful. The application of the wax bulb method in the male is of slight aid.

In the vast majority of cases the process is so far advanced and the obstruction of such long standing that attempts at dilatation seem hardly warranted. The determination of the presence or absence of infection in the urine from each side together with the functional value of each kidney is of great aid in the selection of the proper operative

treatment. If a bilateral hydronephrosis be present with a reduction in the total functional capacity of the kidney procedure is designed to correct the obstruction are infinitely preferable to nephrectomy. In other cases in which the hydronephrosis is slight but apparently progressive and in which the condition is not complicated with infection the conservative plastic operation is the method of choice on the other hand a marked grade of infected hydronephrosis is with full compensation established in the opposite kidney would call for nephrectomy.

If the narrowing does not in the ureteral deeply the author has successfully employed the Heineke-Mikulicz principle converting the longitudinal formerly vertical into one more or less horizontal incision in which the stricture is relieved the upper ureter is drained and the Heineke-Mikulicz principle is not applicable they either amputate the ureter below the stricture and anastomose the free end into the renal pelvis or they follow the method that recollimates the pyeloplasty of Finley.

In the conclusions Geraghty and Frantz say that the most frequent cause is an inflammatory contraction at the ureteropelvic junction and a careful microscopic study disclosed this lesion in a large percentage of cases. In many cases in which aberrant blood vessels enal mobility or abnormal implantation of the ureter have been assigned as the cause of the hydronephrosis careful examination of the upper ureter and pelvis revealed inflammatory narrowings which have unquestionably played the primary role. When the kidney possesses valuable function or when bilateral condition contraindicates nephrectomy the various plastic procedures offer a considerable prospect of success.

Lo G

Pirondini E. Application of Eperimantal  
Atrial to Renal Surgery (Applied  
to the problem of the hydronephrosis) P  
I R m 98 h 6r

By experimental studies Pirondini means the elimination of urea produced by the administration of a solution of urea. The amount administered is 10 grams in 5 ccm of distilled water. The urine is gathered in each of the five to seven half hour periods following and the contents noted. There is customarily a notable increase in urea elimination in the first half hour this is the maximum in the next period and then successively diminishes. The test determination is entirely dependent on the final condition of the kidney. Hepatic conditions are of almost no importance.

The author has applied this method of testing the kidney function in renal surgery and in important vesical lesions. For instance in chronic cystitis a distended bladder tumors of the kidney function is not altered but in cases of a filtrating vesical tumor it is known that the kidney function is seriously altered and this factor is dominant in the prognosis of a surgical operation. The value of the

kidney function is therefore of prime importance in deciding upon intervention

The author finds that experimental azoturia gives results agreeing with those given by the urea secretory constant and the elimination of phenol sulphonephthalein

The author discusses the value of his method of experimental azoturia (a) associated with ureteral catheterization (b) applied to patients operated upon for renal lesion without ureteral catheterization (c) applied to the nephrectomized (d) in case of invasion of the remaining kidney after a nephrectomy or where there is bilateral invasion (e) in cases of pregnancy after nephrectomy. The various findings by the method under each of these heads are detailed W A BRENNAN

### BLADDER URETHRA AND PENIS

Fullerton A Observations on Bladder Injury in Warfare *Brit J Surg* 1918 1 24

Fullerton calls attention to the comparative rarity of injuries to the bladder in warfare the percentage of total wounds reaching the base being not more than 1 in 3 000 or 4 000 His paper is based on a study of 53 cases A few of these cases were seen at clearing stations but the paper deals with the subject from the point of view of a surgeon working at the base

In his review of the anatomy he calls attention to the fact that the bladder in a collapsed state is strictly a pelvic organ and occupies so little space that it forms a very small target for the missiles of war It is reasonable to suppose that just before an attack the state of nervous tension practically always present will lead to an evacuation of the bladder contents whereas if the patient is caught unawares at other times the organ may be in a state of distention The prostate because of its proximity to the neck of the bladder is frequently injured with it

In the 53 cases reported the injury to the bladder was caused by bayonet in 2 cases by shell in 4 cases by bullet (rifle or machine gun) in 12 in 7 by shrapnel in 1 case indirectly by a shell and directly by a fall of earth on the abdomen in 7 cases the nature of the missile was unknown

In about two thirds of the cases the missile reached the bladder by way of the buttock In 5 others there was an exit wound in the region of the buttock communicating with the bladder In nearly 5 per cent therefore there was a wound in the buttock region reaching as far as or actually penetrating the bladder The suprapubic route was comparatively rare Wounds which shatter the symphysis pubis and lay open the bladder rarely reach a base hospital Entrance wounds in the buttocks suprapubic sacral or coccygeal regions or in the thigh or groin should be carefully investigated If a wound of exit is present reconstruction of the track by sectional anatomy may indicate whether it is likely to have involved the bladder or not

The foreign body was retained in 33 cases In 10 it came to rest in the bladder In the remaining cases it lodged in the pelvis or its walls occasionally between the bladder and rectum In one case it lodged just outside the bladder wall while in another it was found later by cystoscopy to be embedded in the wall in process of ulcerating its way through

The entrance wound is frequently of small size and comparatively insignificant on superficial examination The wound in the bladder itself was of the most varied nature Sometimes it was a perforation sometimes a tear or a slit and in one case a considerable portion of the bladder wall had been shot away

The gravity of bladder injuries is greatly enhanced by associated damage to adjacent structures such as intestine or bone Shock is likely to be present when other severe injuries complicate the case According to Wallace it is one of the chief causes of death at the clearing stations

Hemorrhage also contributes largely to the high mortality of wound of the bladder at the front Leakage of urine is one of the most important accompaniments of injury to the organ This may appear at the wound in the parietes or be more or less concealed in the form of extravasation into cellular tissue or leakage into the peritoneal cavity In cases reaching the base a urinary fistula was most frequent in the region of the buttock When the rectum was also injured a rectovesical fistula usually resulted and urine either escaped into the bowel or was discharged often accompanied by feces from a wound in the parietes Retention of urine is quite a common symptom following injury to the bladder If the wound is small distention may occur and require the use of the catheter This applies of course to those cases in which suprapubic cystostomy has not been performed

A sudden sharp pain may occur when the bladder is struck but when the patient reaches the base pain referred to the bladder is not a constant feature There is some tenderness and rigidity in the hypogastrium in a fair proportion of the cases Vomiting is occasionally seen in cases of bladder injury in which the peritoneal coat is intact On the other hand it may be entirely absent in the first hours of an intraperitoneal lesion As in most war wounds fever is commonly present and depends largely upon the amount of infection in the soft parts and bone When it persists pelvic cellulitis abscess formation osteomyelitis or spread of infection to the kidney should be suspected

In examining a case of suspected injury to the bladder attention should be paid to the position and direction of the wounds and to the accurate localization of foreign bodies and present Radio-graphy is of value in this respect Cystoscopy will discover a missile or bone fragment in the cavity of the bladder or a lesion of its wall Rectal examination will give valuable information as regard wounds

of the lower abdominal fluid accumulations in the pelvic connective tissue and palpable for ign bodies. Hematuria usually contains numerous fibrin clots but must be borne in mind that cases of hemorrhagic cystitis have been comparatively frequent during the present. Routine cystoscopic examination is not possible in wartime although the author is able to carry it out in a case of prostatic enlargement types of injury.

The emphasis on the prostatic cellulitis peritonitis extravasation of urine cystitis epididymitis kidney infection of myelitis and necrosis in the interstices of the intervertebral hæmorrhage sac of the recto-vesical triangle of extravasation lung emphysema and intestinal obstruction.

The mortality in bladder wounds is rather high. Will et al. in their unpublished case report of 6 patients and implicated cases the picture of a bladder wound in the author's series.

The final treatment after amputation of the bladder fragments of bone fragments in the bladder wall is the removal of the bladder as a possible. The main danger is the original wound by a high output through the urethra or by urinary fistula. If the latter perforates the perineum in the bladder wall, the diverticulum in the urethra.

2. The bladder is a cessible vessel. Whether the bladder is perforated or ruptured should be considered.

3. After peritonitis must be taken to keep the contents of the bladder in the bladder until the ureters are healed.

4. Careful attention should be paid to the perineal and perirectal cellulitis to prevent a possible extravasation of urine accumulation and the spread of pelvic cellulitis.

5. The ureters in the perineum should be dealt with as thoroughly as the anatomical landmarks of the affected region permit.

The author gives a brief summary of the 53 cases reported in the literature of the most recent examination in the fat of the bladder subsequent to the case that recovered. He feels that the results of injury of the bladder are depending on the extreme and the severity of the injury and kill after treatment in the hospital is possible that one can hope for any definite improvement.

As a result of his study of these cases the author draws the following conclusions:

Injury of the bladder forms a very small proportion of the total wound reaching the base of the bladder.

Their importance from the point of view of prognosis and treatment depends to a large extent upon associated injury.

3. The more usual associated injuries are those of the bones of the pelvic girdle and of other pelvic viscera. The most frequent viscera found injured in cases reaching the base is the rectum.

Injury of the pelvic colon and small intestine are comparatively rare in cases seen at the base.

4. The importance of the pelvic connective tissue cannot be overestimated. It forms a potential cavity in front of the bladder and extends from the cavity of the bladder to the posterior part of the bladder behind. Pelvic cellulitis is a frequent complication.

5. The mortality of bladder injuries is very high. In cases reaching the base it may be estimated at 30 per cent. The chief causes of death have been pelvic cellulitis peritonitis and sepsis.

6. The chief sequelae judged from the reports coming from England up to the present are necrosis of the bladder, stenosis of the bladder, sufficient data are not at present available to enable the author to judge of the frequency of the extension of infection to the kidneys.

7. The treatment should be conducted on a common sense line. Accumulations of infected fluid in the bladder and fecal material in the pelvic connective tissue must if possible be prevented by attention to the original wounds.

If this is successful, usually plan of incision should be made. The fact that the flow of urine from the ureters of a wound is not necessarily an indication for suprapubic cystostomy. If the bladder can be kept clean by irrigation an epithelial urethra from the kidneys does not appear to have a deleterious effect on the wound.

8. Suprapubic cystostomy will drain an infected bladder but will not prevent pelvic cellulitis and epididymitis in the pelvic connective tissue and peritonitis respectively. The after treatment of the bladder by frequent irrigation is necessary to get rid of cystitis and prevent calculus formation.

G. W. H. HARRIS

## MISCELLANEOUS

Walker J. W. T. A Review of Recent Work on Urethral Surgery. *P. 11*. L. d. 98. 3.

The article is a review of recent work on urethral surgery. The author has published the results of an experimental research into the lesion caused by suturing the kidney. The permanent change here found around the suture points in the parenchyma of the kidney in the glandular elements and their epithelium by scar tissue. He concludes that suturing through the renal parenchyma is generally exempt from important complications and does not compromise the general functional value of the organ.

From the work of Eisendrath and Schultz on the route of infection which takes place in ascending infection along the interstitial lymphatics of the ureter the following conclusions are drawn. Infection of the bladder or of the ureter may reach the renal pelvis if the kidney, either by way of the lumen of the ureter or by way of the renal lymphatics. Experiments and clinical evidence

indicate that almost complete obstruction to the free passage of urine is necessary for 1 cent of infection by way of the lumen of the urinary tract. Experimentally the authors claim to have shown that infection set up by the simple introduction of bacteria into the bladder without injury or obstruction may pass upward by means of the interstitial lymphatics of the ureter. The experimental evidence indicates that in cases of pyelitis and pyelonephritis in the human body secondary to infection of the bladder the lymphatics constitute the most important course of the upward travel of infection especially in those cases where there is no hindrance to the urinary flow.

Smith reviews the subject of pyelitis of infancy. In uncomplicated case the pelvis alone is involved the lesion being a low grade inflammation. Many cases show in addition degenerative changes in the renal substance due to extension of the process from the pelvis. In regard to the mode of infection Smith holds that the theory of ascending infection so far as it applies to the pyelitis of infancy has not been proved. The ureteral tract is the source of infection in the majority of cases.

Crabtree and Cabot in discussing immunity in colon bacillus pyelonephritis and its relationship to prostaticectomy believe that prostatic operation upon within three or four weeks after a pyelonephritis are better operative risks owing largely to acquired immunity. The prostatic with uninfected urine who undergo some form of drainage preliminary to operation almost without exception shows some rise of temperature during the period of drainage often presenting symptoms of acute pyelonephritis. The authors try to eliminate the danger of renal infection by administering mixed colon vaccines during the period of preliminary treatment.

Mayo reports a series of 430 patients operated upon for renal stone with a mortality of 0.65 per cent. In 99 per cent of cases the stones were found in both kidneys. In half of the bilateral cases the second kidney was removed. One of the most common causes of recurrence of stone has been due to attempts to conserve a badly damaged kidney and another cause is leaving fragments behind in attempting to remove the stone through too small an incision. A third cause is leaving stones that were not shown by the X-ray.

The percentage of recurrence is under 10 per cent. The operations carried out were pyelotomy in 206 cases combined pelvicolithotomy and nephrotomy in 34 cases nephrolithotomy in 40 cases and nephrectomy in 04 cases.

Kretschmer describes his observations on the use of cystography. He was able to show that the internal sphincter causes bladder closure and that the posterior urethra does not form a funnel or neck when the bladder is distended.

Normally the ureterovesical valve is supposed to prevent a reflex or regurgitation of fluid into the ureter and up into the kidney. By this method he

was able to show that regurgitation can and does take place in normal bladders. Various bladder conditions were studied such as tumors diverticuli etc.

Thomas reports 27 cases of diverticula of the bladder. He classifies them into congenital and acquired types. The ages of the patients location of the diverticuli analysis of symptoms as well as the treatment carried out in this series of cases are carefully considered.

Lowsley after discussing certain obstructions at the vesical orifice concludes that obstructive tumors at the vesical orifice exclusive of adenomatous hypertrophy of the prostate proper are due in 17 per cent of cases to an hypertrophy of the subcervical group of tubules in 12 per cent to an hypertrophic change of the musculature of the trigone at the vesical orifice. In 43 per cent tumors arising from the subtrigonal group are present. 35 per cent of the cases show a fibrous stricture of the vesical orifice and 25 per cent have cystic conditions which cause obstruction.

Randall made a study of 300 autopsies in the adult male ranging from eighteen to eighty three years of age with a view to demonstrating the gross pathological characteristics of median bar formation. From this study the author concludes (1) age is not a determining factor as to the type of bladder obstruction (2) the fibrous types of median bars are due to chronic inflammation which is part of a chronic prostatitis (3) a glandular type exists entirely apart from general prostatic hypertrophy.

Thompson Walker describes his observations on the bladder in gunshot injuries of the spinal cord based on over 430 cases. The condition of the urinary tract is the most important clinical factor in these cases of spinal injury. Urinary infection may be a contra indication to operation on the spine or it may cause death after an operation. It may be fatal when operation has already given promising results or when without operation the case is showing signs of improvement in the nerve lesion. A sequence of two distinct stages was observed in these cases. There is a stage of complete retention beginning at the time of injury during which the bladder is distended with urine. After a time the urine begins to dribble away the bladder remaining distended (retention with overflow). The duration of this stage was on an average fifty five days. A second stage of periodic reflex micturition or active incontinence succeeds the first stage and unless improvement in the spinal lesion takes place this is the permanent state of the bladder. There is a transition stage between the first and second stages during which the bladder is still distended or partly distended with urine but active contraction of the bladder wall takes place. The bladder gradually becomes more contracted until the quantity of urine left after micturition is very small or there is none at all. In the fully developed second stage the bladder is purely a reflex organ.

The sequence of this complete retention followed



by active incontinence with an intermediate stage as observed in all lesions of the cervical dorsal and also of the lumbar region of the cord and occurred even when the lumbar enlargement was destroyed. It developed in more than half of the case of lesion of the cauda equina. Urinary infections the most common and most fatal complication in gunshot wound of the spine and was the cause of death in practically all fatal cases. The infection was due to the catheter and occurred in the first few days after the injury. Ascending pyelonephritis was the fatal complication in all cases and was due to intermittent catheterization permitting the repeated distention of the bladder with infected urine.

The treatment of the urinary tract consisted in provision for the removal of the urine and treatment of the septic complications. Interruptent catheterization was the method usually adopted for emptying the urine. The tied-in catheter has been used in some cases but is unsuitable because it caused sloughing of the urethra and fistula. The author strongly insisted that suprapubic cystotomy should be done in all cases before any catheter was passed and therefore before the bladder had been infected and ascending pyelonephritis resulted (prophylactic cystotomy). The object of the suprapubic cystotomy was to give the freedom of the bladder and prevent intravesical tension for infected urine up the ureters and causing pyelonephritis. To be effective it must be carried out before any catheter has been passed. When cystitis was already present suprapubic cystotomy should still be performed in order to treat the cystitis and to prevent recurrent ascending infection.

An important article by Pedersen on aphasia of the bladder gives the literature and describes two undoubted and two probable cases of this condition. The forms under which secondary syphilis of the bladder appears are very similar to and often practically identical with the non-specific lesions known as simple hyperaemia, simple ulcer and papillary growths. The hyperaemia may be symptomatic. The characteristic ulcer is like the specific ulcer on any mucous membrane situated in an area of edematous infected mucous membrane with a gray base and indefinite prominent firm edge. The ulcers are usually multiple in clusters or widely disseminated and often grouped around or adjacent to or on both ureters and urethra.

In discussing the surgical treatment of bladder neoplasms Beer states that all benign cases suitable for cystoscopic high frequency cauterization can definitely be cured by this method. The following types of cases are unsuitable for this method of

treatment: (1) patients who are intolerant; (2) patients who bleed furiously on every application; (3) patients whose tumors are inaccessible; (4) patients suffering from papillomata of the bladder. These cases and also all those of the tensely benign recurrence should be treated by suprapubic cystotomy and removal by the cautery. A partial cystectomy by means of the cautery is recommended in cases of papilloma which appear clinically benign but do not respond promptly to endovesical high frequency cauterization. When the growth appears malignant cystoscopically partial cystectomy or total cystectomy should be performed at once.

Gerthley reviews the treatment of tumor of the bladder at the Brady Urological Institute. He divides the tumors into benign and malignant papillomata, papillary carcinoma, adenocarcinoma, squamous and sarcomatous carcinoma. In those classified as malignant papilloma there are changes in shape, staining properties and nuclei of the epithelial cells without any decrease in filtration. Experience has shown that patients die of cancerous metastases when the changes in the papilloma are the only evidence of malignancy. When the malignant papilloma has advanced to a point where infiltration of the bladder wall has occurred the author uses the term papillary carcinoma. Cystoscopy and the clinical method proved of greater service in differentiating between malignant papilloma and papillary carcinoma than histological examination. Fulguration was employed in 53 cases 2 of which were inoperable adenocarcinoma. In none of the carcinomata did the fulguration make any impression on the tumor.

Thirty-four cases of tumor of the bladder were treated by excision and of these only four were known to be eliminated free from recurrence during a period of five years or over. Excision should be used only in cases which would ordinarily be suitable for fulguration but in account of some complication that treatment has become impossible or very difficult.

Barringer reviews a year's work with adium in the treatment of carcinoma of the bladder and prostate. In carcinoma of the prostate striking results were obtained both in early and advanced cases. In early cases in which the carcinoma was fairly well confined to the prostate and the ureters little or no prostatic resection or shrinkage of the carcinoma could be obtained. In the observed cases the reduction was permanent. Ten months was the longest period of time for which any of these had been followed. Very large carcinomata of the prostate were beyond the help of radium.

H. L. KRETSCHMER

# SURGERY OF THE EYE AND EAR

EYE

Burleson J H A Method of Repair for Corneal Injuries *Texas St J Med* 1918 ix 172

The author proposes a method of conjunctival elevation circumcorneal in extent with elevation of the conjunctiva well back over the globe in all cases of rather extensive injuries of the cornea. The iris is replaced if possible where there is prolapse of that structure or excised if deemed necessary. After flushing the conjunctival sac with normal salt solution a No 2 ten day catgut purse string suture is introduced and when tied brings the conjunctiva together in such a way as to cover the entire cornea. A pressure bandage is applied. The suture is not removed but is allowed to absorb which allows the conjunctiva to gradually recede from off the cornea and take its normal position and reattachment at the corneoscleral margin.

Case reports are given of six instances where this method was used with gratifying results to the author. It is cited that the use of this method in his hands has given a prompt repair of the cornea in all cases. He believes that often an eye may be saved by this method where otherwise its enucleation would be the only other alternative.

J S CLARK

Langdon H M and Jones I H The Intimate Relation Between the Ear and the Eye as Shown by the Barany Tests *Arch Ophth* 1918 xlvii 348

The purpose of this paper is to call the attention of ophthalmologists to the governing power of the ear over eye movements and equilibrium. It is not yet generally recognized that the ocular mechanism is dependent upon the ear stimuli for precision of movement. Steadiness of central fixation is made possible only by normally acting ears. Tonic impulses from the right ear continually tend to draw both eyes to the left and tonic impulses from the left ear continually tend to draw both eyes to the right. This is definitely proven in sudden loss of function in one ear and can be shown experimentally by the application of the galvanic current.

Aside from the production of nystagmus experimentally the ear in many animals has a decided influence on ocular rotations. Barthel makes the statement that section of the acoustic nerves in rabbits produces complete loss of eye movements and in extremely young children he says it is impossible to produce rotary nystagmus and although the auditory apparatus is already exerting some influence the results of ear stimulation are irregular eye movements. Nystagmus of the blind is entirely separate from that produced from the ear occurring

because the blind person is not aware of the position of his eye.

The equilibratory portion of the ear consists of two tiny sacs known as the utricle and saccule and of three semicircular canals. The utricle takes cognizance of movements in a linear direction anteroposteriorly and the saccule of movements in a lateral direction. The semicircular canals are so constructed as to detect rotary movement of the body in all conceivable planes. Such is the complete control of the ear over the eye motions that a nystagmus of any type and in any direction may be produced by appropriate ear stimulation.

The recognition of the ear as the chief equilibratory organ is so recent that most of the intracranial pathways are still undetermined and the authors express their belief of what these are based on a study of over 600 clinical cases and a considerable number of operations and autopsies.

No case of eye muscle paresis paralysis or nystagmus can now be considered as completely studied unless the results of ear stimulation have been noted and the authors suggest that in muscle paresis ear stimulation by means of electricity might be used therapeutically.

S S HOWE

Velter E Ocular Disturbances Accompanying Wounds of the Head (Les troubles oculaires dans les blessures du crâne) *Arch d'ophth* Par 1918 xxxv 179

Velter's long and finely illustrated article on eye lesions accompanying war injuries of the head is divided into three parts treating respectively craniofacial wounds and the early and late ocular symptomatology of penetrating cranial wounds. Histories of a number of war cases in the author's practice are given.

Velter thinks that the complete study of these lesions and of their symptoms belongs to the domain of ophthalmology yet the general surgeon ought to know how to recognize and treat them when needed because in the early hours after injury careful attention may prevent irreparable injury later.

The eye may be injured at the same time as the cranium under two conditions (1) the two wounds may be independent produced by different projectiles both eyes may be attacked (2) the cranium and the eye may be injured by the same projectile in which case there is a large craniofacial or cranio-orbital wound.

Whether an injury belongs to the first or second group the following course of treatment should be adopted according as the ocular globe is more or less injured.

1 If there is no visible ocular wound this is a contusion with indolent trauma. Ordinarily

mydriasis etc. There are some contusions which cause lesions of the deep membrane of the eye visible much later. There is no special treatment for this class of case.

2 When the ocular globe is more or less destroyed nothing is to be gained by delay and enucleation or rather the regularization and extraction of all fragments of the sclerotic as far as the optic nerve should be done. The sparing of the conjunctiva is very often forgotten but its preservation is essential for early cicatrization and for the ultimate prosthesis. Likewise the ocular muscles ought to be respected as well as the iraponeurotic structures.

3 When there is a limited penetrating wound of one or both eyes the wound may be scleral sclerocorneal or corneal and there may be hernia of the iris and injury of the crystalline lens.

The treatment may be limited to the application of an occlusive dressing after sterilization of the eye and lids but if ophthalmologic treatment is instituted at once the patient will greatly benefit. This consists of (a) lavage of the eye and lids after cocaine anesthesia (b) use of the electromagnet to be sure that there are no projectile fragments in the eye (c) resection of the scleral and corneal reduction of the angles of the coloboma (d) curettage of the crystalline masses (e) conjunctival closure of the wound after auterization of the edges with the galvanic cautery (f) occlusive bandage (g) injections of cyanide of mercury solution during the first few days such injections effectively combat the early infections in eye wounds and even if there is no other treatment these injections should always be made at the front they may prevent the loss of the eyes (h) extraction of a projectile if it has been radiologically located. W A B 44

## EAR

Richardson C W Ear Protectors L E P  
1918 U S 4

With a view to determining the relative merits of the various ear protectors against concussion deafness the author has had experiments made on animals from which he has deduced the following conclusion.

1 Of the four protectors tested (British Tommy Mallock Armistorg Baum and Wilson Michelson) the British Tommy is the best.

2 Cotton is efficient only when moistened with glycerine or vaseline. It deafens the wearer more than the Tommy.

3 It is recommended that since although of the Tommy protectors be purchased and is used to the troops with orders to wear them the same as their gas masks.

4 It is recommended also that cotton saturated with glycerine and vaseline be used to a certain

number of men so that the relative merits of the Tommy and aseline cotton can be determined.

OTTO M ROTT

Wilson J G The Effects of High Explosives on the Ear J Am M 1 9 81 68

The author gives the results of his experience with the American Expeditionary Forces in France.

Otologic cases resulting from bursting of a shell are divided into Group A in which a piece of shell hits the ear or structures in its immediate vicinity Group B in which damage has come from the explosion alone no fragments striking the ear. This report deals with Group B cases only.

War deafness is common on account of the high explosive shell used. Concussion effects are no longer confined to artillery men alone but to all classes of combatants. The effect of a high explosive on the ear is a great compression followed by a great decompression the former probably causing the damage.

Common gross pathologic effects of explosions on the ear are (1) rupture of the drum head (2) hemorrhage into the middle ear spaces (3) hemorrhage into the fundus of the internal meatus at the point where the nerve enters the bony canal. The vestibular apparatus as a rule shows very little change. Lesions (1) and (2) cause a certain loss of hearing while (3) may give rise to deafness tinnitus giddiness and other symptoms of an inner ear lesion.

In addition to total loss or diminution of hearing the following nerve symptoms were sometimes associated with these cases: exaggeration of tendon reflexes tremors vasomotor disturbance sweating lethargy sleeplessness headache vertigo with disturbance of equilibrium Numbness of the field of vision and thermal anesthesia as also noted in some cases.

Eighteen out of patients seen soon after injury showed lesions of the drum membrane. Three of the remaining 4 had a history of old ear trouble. In addition to deafness these patients complained of vertigo. Of 8 cases examined for this symptom 7 showed definite signs of labyrinthine vertigo.

Cases seen some time after injury were divided into three groups: (1) those with nerve deafness (2) those who have nerve deafness of varying degree in which the patient hears without being conscious of doing so (3) malingerers.

The author discusses cases belonging to Group 1. The use of vibrating tuning forks the voice used through resonators and carefully graduated physical exercises were the means employed to stimulate the auditory mechanism.

Therapeutic treatment is considered a success if afterwards the patient hears sufficiently to be able to reject his opponent. J A W NTE

# SURGERY OF THE NOSE, THROAT, AND MOUTH

## NOSE

Byfield A H Systemic Manifestations of Chronic Nasal Sinus Infection in Childhood *J Im M Ass* 1918 lxxi 511

The author's conclusions are

1 Infection of the accessory nasal sinuses is greater than has hitherto been commonly suspected

The possibility of this infection as a source of general bodily involvement deserves more attention In a series of cases including chronic digestive disturbances persistent cough occult temperature poor general health asthma infectious deforming arthritis and cyclic vomiting sinusitis has been observed and a definite relationship between the infection and certain metastatic processes has been established

3 Symptoms such as chronic purulent nasal discharge (especially in winter) sneezing headache depression and irritability suggest the possibility of an infection of this region provided that other etiologic factors have been excluded

4 The diagnosis may be made by the roentgen ray but exploratory puncture or even curetting may be necessary

5 The treatment should be conservative and expectant unless the trouble persists and continues to affect unfavorably the health of the patient In the light of present knowledge surgery is indicated

Otto M Portt

White L E An Operation for Bony Occlusion of the Posterior Nares *Laryng scop* 9 8 11 571

The author's method is to cut through the obstruction with a chisel making a triangular section then punching out the margin and smoothing with a curette The posterior end of the septum is then removed by ronguers or curette and after being smoothed off carefully it is covered with the mucosa which had been previously cut and elevated from this portion

Two cases are reported with excellent results

Otto M Portt

## THROAT

Arrowsmith H The Surgery of Laryngeal Malignancy *Tr Am Laryngol Ass Atlantic City* 1918 May

From the author's observations of Mackenty's work and his own recent experience modeled very closely thereon he is inclined to tentatively suggest the adoption of Moore's antecedent tracheotomy to accustom the lower air passages to the direct impact of air which may lessen their immediate postoperative irritability and susceptibility the

tracheal opening should be made high as Jackson has indicated because that will not interfere with the later mobilization of the trachea Otherwise the two step operation seems to offer no special disadvantage

This is the ideal field for the employment of oil ether colonic anesthesia as devised by Gwathmey It makes the whole procedure infinitely easier for both patient and operator Even if really painless under local anesthesia such an ordeal produces an enormous apprehension which cannot but be detrimental to the patient and the degree of infiltration of the tissue necessary to produce insensitiveness must interfere with their repair With rectal anesthesia laryngeal spasm does not occur bleeding is very much less there is no tracheobronchial irritation from the directly inspired anesthetic which very largely obviates the necessity for subsequent repeated applications of the suction apparatus in itself an agent of some danger and there is much less likelihood of postoperative vomiting most undesirable under these conditions

The laryngologist for every possible reason is the man who should do laryngeal surgery both external and internal If he saw all these patients at an early date thyrotomy would more often be performed

Laryngectomy cannot be repudiated on any such grounds as the mutilation or the loss of voice Laryngectomized patients are in no worse case than the blind the deaf or the helplessly crippled Many of them seem to get a fair amount of happiness out of the mere fact of existence and are not by any means incapable of self support In judiciously chosen cases this operation offers a good deal more than a probability of clinical cure and in most instances a definite retardation of the fatal ending

Of two cases operated upon by the author one died six weeks later of pneumonia The other is in good condition now six months after operation and is at work

In a third case in whom only a tracheotomy was done the final sufferings were so great that the author regrets that he did not give the patient a fighting chance by as far reaching a dissection as possible rather than witness such suffering as this man endured during the last six months of his life

Otto M Portt

Rush C C Retropharyngeal Abscess *J Im M* 111 1918 lxxi 174

Rush reports the following causes of infection leading to abscesses posterior to the pharynx

1 Cases of the upper cervical vertebrae usually of tuberculous origin Such an abscess being dorsal

to the prevertebral fascia is very apt to burrow laterally and appear as a tumor in the neck dorsal to the sternocleidomastoid muscle where it should be opened under strictest asepsis to prevent a mixed infection. If unopened it may follow the brachial plexus into the axilla. Regarding the prevertebral fascia it may however burrow forward in the midline of the pharynx.

Otitis media. The pus probably burrows downward into the upper part of the eustachian tube along the tensor tympani muscle to terminate behind the prevertebral fascia. It tends to point in the same direction as the infection from the cervical vertebral caries.

3. An extension upward of a carotid abscess.

4. Infection of the lymph nodes of the retropharyngeal space. These nodes are one on either side of the midline opposite the lateral mass of the atlas. They receive lymphatics from the nasopharynx, eustachian tube, nasal fossae and accessory sinuses. M. N. I. ER. F. EL.

### MOUTH

Lyon, C. J. Some Vascular Phases of Fracture of the Jaw. J. T. M. I. 981 64.

Lyon calls attention to the fact that fracture of the jaw will differ from fractures in other parts of the body in that they are more liable to infection on account of the loose permeability of the bacterial fluids of the oral cavity.

He calls attention to the consideration of infection in a fracture of the jaw, the presence of alveolar abscesses, which may be extending at the time of the fracture may be superinduced by the injury. This will greatly delay the process of repair and should be eradicated before paracantheliasis.

In the condition which complicates healing of jaw fractures infection of the antrum.

The treatment of fracture of the jaw consists of the fulfillment of three principal indications: (1) reduction of the broken fragments; (2) retention of the parts in normal relation; (3) prevention of the inflammatory process. M. N. I. P. D. L.

Ochsner, A. J. Clinical Observations Concerning Malignant Tumors of the Jaw. J. S. G. I. 981 36.

Ochsner reports his observations of 100 cases of malignant tumors of the upper and lower jaw from the standpoint of the clinician. The antiseptic cautery was used in every case in a most vigorous manner. Two cases died from hemorrhage from the carotid artery, the tumor had extended into the neck. The latest one of his cases operated upon by means of the cautery has lived twenty-nine years since the operation and is still in excellent health.

Out of 100 cases 67 per cent were carcinoma 6

per cent epulis 6 per cent sarcoma and per cent chondrosarcoma. The origin of these neoplasms was noted and in the case of carcinoma and epulis the following distribution was found: 47 cases originated from the lower maxilla 25 from the upper maxilla 6 from the antrum of the maxilla 3 from the lower lip 1 from the parotid gland and 1 from the palate bone.

In the arc maxillary growths the examination showed that 8 cases originated in the upper maxilla 4 in the inferior maxilla 3 in the parotid gland the soft palate and 1 in the cheek.

Ochsner believes that the teeth are usually the cause of malignancy in the jaws. He holds that broken down crowns and sharp projecting roots together with faulty constructed bridges and crowns affording a breeding place for bacteria are predisposing factors.

The frequency of occurrence of the malignant tumors in the male is found to be much greater than the percentage given by Blair. Of the cases occurring in the male 28 affected the female. The percentage for the female is considerably lower in the case of carcinoma than in those of sarcoma and epulis. Of the 6 cases of carcinoma it was found that only 1 were female patients while in the 33 cases of sarcoma and epulis 1 were female patients.

As to the duration of the condition before the admission of the patient into the hospital the following statistics were determined: 25 per cent entered before the third month 2 per cent of cases entered before the sixth month per cent before the second year 7 per cent after the second year. In 6 per cent of the cases no treatment was made with regard to lymph gland involvement. Of the remaining 93 cases 5 showed enlarged glands.

The mortality following the operation was as follows: 3 per cent died during the first day following operation 4 per cent died before the fifth day 5 per cent died before the twelfth day 3 per cent died before the twentieth day and per cent died after the twentieth day.

The total mortality of the patients while in the hospital amounted to 2 per cent. All of the fatal cases except two were carcinoma of the jaw.

It is interesting to note that in 4 per cent of these fatal cases a complete operation or an excision of a piece of tissue for diagnosis had been performed. In the balance of the cases injection of iodine or application of plasters of acid teeth extract followed the operation; the lesions or x-ray application had been carried out.

Of the 100 cases treated this series returned with recurrences. Ten returned once, 6 returned twice and four returned three times. The permanent results of this series of cases have not been determined. M. N. I. P. D. S. E.

# BIBLIOGRAPHY of CURRENT LITERATURE

## GENERAL SURGERY—SURGICAL TECHNIQUE

NOTE—The bold face figures in brackets at the right of a reference indicate the page of this issue on which an abstract of the article referred to may be found

### Operative Surgery and Technique

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## SURGERY OF THE HEAD AND NECK

## Head

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for two years with no pathologic symptoms exhibition  
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## SURGERY OF THE ABDOMEN

## Abdominal Wall and Peritoneum

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 R I Am J M S 98 1 9 [474]  
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 ROJA S m m d B 1 98 74 [475]

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